THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.

Calcutta:
PRINTED AT THE "STATESMAN" OFFICE.
1879.

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Printed at the "Statesman" Office.

Registered No. 166.

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VOL. IV.] CALCUTTA: WEDNESDAY, 1st JANUARY, 1879. [No. 1.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

BAMBOO: ITS CULTIVATION FOR PAPER STOCK.

SIR,—My last letter to you of the 7th October, was based upon an extract from the Royal Botanical Garden Report 1877-78. Having the Report now before me *in extenso*, published in your October journal, I trust you will allow me space for a few additional remarks thereon, especially as, examined dispassionately, I submit that the conclusions drawn by Dr. King from his experiments "*that the proposed new industry does not present a hopeful financial aspect,*" are not only not justified, but must be regarded as being very far from conclusive, and that if a little more careful consideration had been given to the habit of the plant, a very different result would have been arrived at.

In February 1876, Dr. Brandis, the Inspector General of Forests, in India, issued a printed Memorandum directing attention to the main points to be determined by the experimental plantations of bamboo then ordered to be established by the Government of India. I assume therefore Dr. King's experiments had their initiative from this order. Why, then, he should not have at least tested the *various systems* of cutting or cropping the bamboo therein suggested, and not confined his experiments to the *one solitary system* he prophisied would not answer, unless it was to prove a "foregone conclusion," I must confess myself utterly unable to understand. I should have thought that on the contrary a scientific investigator would have tested every system that offered a prospect of a successful result.

I extract the following from Dr. Brandis' Memorandum above alluded to.—

"A method of treatment must, if possible, be discovered by which a "plantation, or natural forest of bamboo, may be made to yield a "succession of complete crops of young shoots throughout the year. "Our present experience is that a large proportion of *old stems* is "required in a clump to produce full-sized shoots. . . . . "Under ordinary circumstances, if bamboo clumps are cut over in the "forest, all mature stems being cut down at one time, the result is "a crop of slender stems, It requires no experiments to establish this "result . . . . Entire clumps of different species and of different ages "growing under the most favourable conditions should be operated on, "and these experiments should as much as possible be comparitive: "of a number of clumps of the same age and species, and growing "under the same conditions some should be thinned lightly, others "heavily, and the third group should be cut over completely, leaving "only a few old stems on the ground."

As you have published (in your March journal) Mr. Thomsons' letters to Sir Joseph Hooker, on the cropping and cultivation of bamboo, I beg to add the opinions of several other acknowledged scientific botanists bearing on these points at issue.

The most exhaustive work and generally accepted text book on the *subject is the Monograph by General Munro, C. B., published* in the transactions of the Linean Society, of which, like Dr. King, I have the honor of being a Fellow. General Munro did me the favor in September 1876, to reply to certain queries I had transmitted to him as follows:—

"I have never heard of the bamboo being cultivated for successive "cropping, but I see no reason why a regular systematic cropping could "not be carried out. *Bambusa Vulgaris* would in my opinion be the "best species to cultivate, as it grows very readily from cuttings; so does "*Dendrocalamus Giganteris*, which thrives remarkably well and grows fast "in Trinidad, W. I., and would I think produce the best fibre. *Bambusa* "*Tulda* would be a good species in India; *Dendrocalamus Strictus* also "grows fast and is easily propagated: the ordinary bamboo very rarely "seeds in the West Indies; I only saw it once in Jamaica, it is *always*

"increased by cuttings. I don't think these should be put in at a less "distance than five feet apart; a fair sized bamboo will produce from "10 to 20 shoots a year in moist countries. With reference to cutting "and cropping, I should think that 6 or 7 out of 10 shoots might be cut "yearly, without causing any serious harm to the parent stool; the "older stems might be cut down in their second year to serve as fuel: "I should think that the stools would continue to produce fresh stems "for about 30 years, about when the plants would be likely to come "into flower and then die."

The late Mr. Sulpiz Kurz, well known as an authority on bamboo, and whose most interesting papers thereon were published in the *Indian Forester*, in a long correspondence with me, replied to some queries as follows:—

"If all the shoots be cut down, the stock will be impoverished and ultimately die off, hence a certain percentage, say, one-fourth of the whole of "the stool, would have to be spared. The most common way of planting "bamboo by natives is by taking shoots, or the lower piece of the halm "with a part of the rhizome and plant during the rains, the intervals "between the cuttings being regulated by the size of the bamboo; 12 to "15 feet would be dense growth; for the larger kinds 80 feet and upwards, "which throw up from 15 to 20 shoots, while 8 to 10 feet is the "minimum for the smaller kinds above 30 feet; smaller kinds are not "recommendable."

Dr. Parish, a botanist well acquainted with Burmah and the Tenasserim Provinces, communicated with me as follows:—

"The shoots should not be all cut every year, for if this were done, the "root stock would die; only about half the clump should be cut yearly. "The bamboo once established as a strong root stock, you can go on "cutting annually; as to the calculation of 7,488 stems per acre (*vide* "my pamphlet p. 8) I should think that if only half were cut a much "greater number could be got off an acre."

Dr. Bethold Ribbenthrop, Conservator of Forests, Northern Division, British Burmah, to whom I had sent Mr. Thomson's letters requesting his opinion of the views as to cropping and cultivation, expressed therein, replied: "There is no doubt that in fire-protected plantations a much "larger crop can be obtained than in the open forest exposed to "constantly recurring jungle fires. The bamboo jungles near villages "on the Pegu choung, prove that constant cutting does not materially "affect the reproduction, and cutting them down within a couple of "feet from the ground, maintains a perfect unimpaired action of the "roots, as may be observed on the bamboo hedges in Rangoon. At the "same time I cannot agree with Mr. Thomson that a bamboo "plantation may be kept up indefinitely in regard to time, at least not "without re-stocking: this has been the case with the artificial plantations of *Dendrocalamus Brandisii* here in Burmah, original stocks of "which die after about 60 to 70 years, others would doubtless be "shorter lived.

"The *Dendrocalamus Brandisii* plantations in Burmah, are kept up "by inter-planting with new stocks. Mr. Thomson's system is "doubtless the correct one; to grow bamboos like sugar-cane, and to "replant after cutting the crop seems to me impracticable, the "maturation of small bamboos taking at least 2 years, that of the "larger kinds 5, 6 or 10 years."

In another letter Dr. Ribbenthrop addressed me, he said: "All my "observations regarding the growth of many species of bamboo tend "to prove that you are perfectly correct in your views, and that by "artificially irrigated plantations we can force the productive power "of bamboo stocks to a very great extent, on the Pegu choung and "the Beningdat, the most luxurious growth is found close to the water "courses, where they are most severely cut for the bamboo trade, "the banks of the Attaran river are for upwards of 50 miles fringed "by a broad belt of large dense growing, but for general purposes, "useless bamboo."

There are yet other points in Dr. King's Report I should like to discuss, but having already occupied so much space, I must leave these for another letter.

Claxheugh, Sunderland, 30th October 1878. THOS. ROUTLEDGE.

BAMBOO PAPER.

SIR,—This is largely manufactured in China. Fortune, at page 270 of his *Two Visits to the Tea Countries of China*, says:—

"While these thoughts were passing through my mind, my people arrived, and, getting into my chair, I proceeded across the valley. About a mile below the temple (of Shante-Maon) I observed a a manufactory for making paper out of the bamboo. Large stone tanks were constructed in the fields for the purpose of steeping the bamboo stems. They appeared to be steeped for a length of time in some solution of lime. They were then taken out and beaten upon stones until they became quite soft, or until all flinty matter which abounds in their stems was removed."

This note occurs on his journey from the Woo-e-shan district to Shanghai, *via* Ching-hoo.

I send this to you to suggest the advisability of opening communication with the Anglo-Chinese authorities, for information regarding the cultivation of the bamboo and its manufacture into paper.

G. P. P.

NEGLECTED FORESTS.

SIR,—As sâl wood is now selling at such high prices, and as Government is preserving forests where practicable, it may not be out of place for me to call the attention of the proper authorities to the fact that there exist in North Bhaugulpore 70,000 to 80,000 or more biggahs of sâl jungle, which is being annually cut for firewood and stolen by the jungle residents for converting into charcoal and ploughing implements. The zemindars, who are a needy set, frequently sell it at Rs. 10 to Rs. 15 per biggah, and do not seem to appreciate the value of their possessions. The trees vary from 10 to 40 feet in height, and if the brushwood were cut down and proper conservative measures adopted, it can be well imagined how the value of the forests would increase. Under the present system of annual demolition it seems probable that 30 years will see the last of these promising forests.

PEACOCK.

MUMMY WHEAT.

SIR,—I had a discussion with a friend who maintains that there is a species of wheat called "mummy wheat" grown extensively in England, and the seed of which was originally found in the swathings of mummies in Egypt. I said that this was a popular delusion, that it was impossible for any seed to retain its germinating power for 3,000 years or more, and that I had the authority of Lindley in his work on horticulture for my belief. My friend does not care for Lindley. He would be satisfied by your decision in the matter, whether wheat or any other seed could retain its germinating power for so long.

MUMMY WHEAT.

NOTE.—The wheat referred to is the *Triticum compositum* or many-spiked wheat, a distinct species, coming from Egypt and cultivated in a few places in England, but not extensively. Some wheat that was obtained from the swathings of mummies over 2,000 years old, was found to germinate, and yielded plants of identically the same species. Hence the name "Mummy Wheat." But it is by no means proved that this species has been extinct in Egypt and revived only by seed found as mentioned above. Still the fact in which our correspondent would seem to be specially interested, is beyond doubt, *viz.*, that corn has in modern times been raised from the seed found in a mummy case.—ED., *I. A.*

THE SAME.

SIR.—Your note to my letter of the 3rd instant does not clear up the point in dispute between my friend and myself; in fact the only additional information your note gives is, that the wheat called mummy wheat is the *Triticum compositum*, and that it is not grown *extensively* in England. You do not decide the main point, whether the seed obtained from the swathings of mummies is the identical seed put in there when the mummies were embalmed. Supposing any seed were really put in with them, my friend and myself are quite agreed on all points except as to the identity of the seed. I have the authority of Lindley for my belief that it is not the same seed that was put along with the mummies. Will you kindly tell us if botanists believe that the seed from the mummies, from which the *Triticum compositum* has been propagated in England, is of the same age as the mummies?

MUMMY WHEAT.

NOTE.—There is no reason to doubt that the wheat found in the swathings of Egyptian mummies is of the same age as the mummies themselves.—ED., *I. A.*

DEGREES IN AGRICULTURE.

SIR,—We have heard good deal lately of the Governor of Bombay's wish and intention to develop the C. E. College at Poonah into a College of General Science and Agriculture; on which subject, Mr. Robertson, the Head of the Agricultural Department of this Presidency, lately proceeded to Bombay in order to consult and advise Sir R. Temple. You have often in your columns urged the advisability of the local University instituting something of a similar nature, and have pointed out how much more beneficial it would be to the country at large, if we turned out a number of Bachelors in Husbandry, instead of B. A's. In the Civil Engineering College at Chepauk, and the Agricultural College at Sydapet, two excellent institutions exist, which, if combined, would

be able to inaugurate such a course of study, as would enable a thorough training to be given in Civil Engineering, General Science, and Agriculture, and thus enable the University to grant degrees in Science, and Husbandry, as well as in Civil Engineering, as they do at present. That the Civil Engineering College would benefit by removal from Chepauk to Sydapet, there can be little doubt, and much greater opportunities must exist at the latter place than at the former, for teaching the practical portion of the Civil Engineer's profession. The building at Chepauk, now occupied by the C. E. College, would afford room for some of the offices at present overburdening the Fort.

The University, however, would require to modify its Faculty of Civil Engineering, in order to include General Science, and Agriculture. The future constitution of the Faculty might be something as follows :—

Chief Engineer.
Chief Engineer for Irrigation.
Consulting Architect.
Principal of the C. E. College.
The Head of the Agricultural Department.
One of the Professors of the Agricultural College, either Chemistry, Natural History, or Veterinary Medicine.
A Second Scientific Agriculturist.
The Government Astronomer.
The Chemical Examiner.
The Director of Public Instruction.
The Conservator of Forests.

Such a body would be fairly representative of the three subjects with which it would have to deal ; its only fault, perhaps, would be in being too weakly represented in the agricultural division ; agriculture being it is now acknowledged of at least as great importance in this country as Civil Engineering.

If Government would insist that all its subordinate revenue officials should obtain a degree in husbandry, the advantage to the country would be enormous ; and with a view to such a contingency arising the University should not be unprepared.

SUGGESTION.

December 13.

FERN-CULTURE.

To the Editor of the Madras Mail.

SIR,—Will some one of the many readers of the *Mail*, versed in plants, inform me how the fern best known as the *Cycas* and *Zamia* may be re-produced. The trunk is mostly under-ground, and is about two feet long by two feet in circumference. The leaf is about four or five feet long with small narrow leaves on each side of a long stem. I have made many attempts at transplanting slips and roots, but all have failed. As many friends are anxious to have it, I would feel obliged if some one will favor me with the information.

FERN.

Nellore, December 4.

THE SAME.

To the Editor of the Madras Mail.

SIR,—In reply to your correspondent " Fern " I beg to state that *Cycas* and *Zamia* are not ferns, but they comprise a genus of plants allied to palms and ferns. They are produced readily from seed ; but are slow growers. They abound in the Malabar district. Many of these plants may be seen in the gardens on the side of the high road leading from Beypur to Calicut. They are also met with in the Salem district ; some two or three years ago, I collected a lot of seed for distribution at the foot of some hills about five miles from Sunkerydroog on the high road to Trichengode ; as also from some plants found growing on" Morison's Farm " at Palmanair.

The male and female plants are distinct, the seeds form nuts about the size of a common hen's egg, but quite round, hanging down from the plant from a spadix resembling somewhat a miniature form of the fruit of a cocoanut tree. I have two plants now from seeds put down nearly three years ago, and they are only about a foot in height and have two fronds each. They may be grown from cuttings of the fronds. Occasionally some plants throw out suckers, these when separated will thrive. I should say the nuts or seeds are the best means of propagating the plants ; they are eaten by the poor, ground into a flour and cooked in a sort of kunjee. The cycads with age, attain from five to eight feet in height, when much of their beauty is lost by their lanky stems.

JOHN SHORTT.

12th December, 1878.

EUCALYPTI IN INDIA.

SIR,—The gum trees of Australia have in some localities been introduced into this country for above a decade. I write to inquire, whether they have been known to bear fertile fruit anywhere as yet? There is a plantation near the bunds of the Chenab, in which there are at least fifty trees of the *Eucalyptus-resinifera* or *E. pepera* planted from seed imported by a Railway Engineer ; they are about six years old, have grown very rapidly, and they have borne carpels, but as yet do not seem to be fecund, they probably are the first fruits of trees which are not yet adolescent. However some information on this interesting family of trees would be useful. Much ignorance of them prevails ; for instance a friend used to go about splitting the bark up with a stock-knife to prevent them from being hide-bound, as he termed it. The trees on the bank of the Chenab appear to have an healthy influence on the malarious character of their immediate locality ; the pleasant odour from them can be snuffed in the air. It may be as well to point out, that Lahore has recently become very unhealthy owing to the extensive plantations of " sheshum " trees. The forest department ought to know, that these are an unwholesome kind of tree to plant in marshy ground, the stench from their leaves rotting is very offensive. I would suggest that these plantations be cleared away, and the *Eucalyptus* planted, which thrive amazingly in such moist soils and are so salutary.

W. J. B.

AGRICULTURE IN EUROPE.

(FROM OUR CORRESPONDENT.)

PARIS, NOVEMBER 7.

IT is up-hill work to be an innovator. M. Faucon for several years has saved his vineyard from the phylloxera by inundating the vines in autumn for two months, and liberally manuring them in spring. People disbelieve him, although he invites the incredulous to come and see. M. Goffart, of Burtin, is another case in point ; he has introduced the plan of feeding and fattening stock on chopped green forage, preserved in trenches, during every season of the year—winter and spring especially ; he also is despised and rejected. He lately invited the agriculturists from all parts of the world, brought together by the Exhibition, to witness his system at work. Some 100 cosmopolitans accepted his princely hospitality, extending to even placing a special train at their disposal. The carts laden with the freshly cut Nicaragua maize-stalks of giant proportions, discharge their loads ; the stuff is raised by machinery, driven by a turbine which also works a saw-mill, and passing from the feeding board to the knives, it is chopped into rings one-third of an inch thick ; thus shaved the stuff is again lifted, and slides down into the trench, where a man and woman spread and tread it ; when full, the trench is covered with boards, on which large stones are piled at the rate of 8 cwts., to the square yard. In this condition the forage will keep admirably, and without fermentation, till required for use ; it will remain for months without becoming heated or deteriorated. The trenches are 40 feet long, by 16 wide in cement, and the roof is 6 feet above the well, to allow room for working the planks and the stones. Beside the building is the old trench, sunk in the soil, and filled with cut green rye, since May last perfectly preserved. The trenches, or reservoirs, are elliptical, because corners interfere with safe pressing down. M. Goffart has 68 head of cattle, and has sufficient fodder thus conserved, to feed or fatten 90 more. The stuff when taken from the pit, is at once served to the animals, who devour it with a gusto.

In the south-west of France, cotton-seed cake is entering largely into the dietary of farm stock ; the preference is given to that prepared from Egyptian seeds, as it contains fewer filaments of cotton, is more nutritive, and less liable to become musty. It is in Marseilles this kind of cake is obtained, where each manufacturer is obliged to stamp on each cake the trade mark of his establishment—a guard against fraud. Cattle and sheep eat the cotton-cake with avidity when simply crushed, and without any mixture ; it takes the place of meal and potatoes, when joined to beet, for the feeding of pigs, and horses accept it with their oats, chopped hay, or bruised maize. It resists best humidity, as compared with linseed, colza, or hemp cakes, and is cheaper—6 francs per 112 lbs., taken at the factory. Cattle may be given 6 lbs. daily of cotton-cake, pigs 2, sheep ¼ of a lb. and horses somewhat less. The chief objection against hemp-cake lies in the difficulty of preserving it in large quantities for any length of time ; it is best when obtained daily from the mill ; it is nutritive and cheap, though some allege that it is heating, especially for young animals, like colza.

There is but one regret to register in connection with the agricultural section of the Exhibition, *viz.*, that all the implements and machinery, instead of being scattered over the palace in annexes, had not been concentrated in a single building. Class 51 comprised agricultural implements, besides processes employed in the cultivation of fields. There were 496 exhibitors; France had 207; England and her colonies 83; United States 41; Belgium 18; and Russia 24. There were shown a total of 248 ploughs, 137 threshing machines, 28 scarifiers, 62 mowers, simple and combined; 58 reapers, 104 sowers, and 20 machines for tilling land by steam. The jury consisted of 13 members; 5 for France, 2 for England, 1 for the United States, and the remainder for other nations. The jury devoted 86 days, of three hours each, to the actual examination of the exhibits, and 12 more to deliberations. Eight nations, though competitors, obtained no prizes. China, Japan, Central and South America, Portugal &c. There were awarded, 6 Diplomas of Honor, 32 gold medals, 79 silver, and 89 bronze ditto, *plus* 78 honorable mentions, or a total of 284 recompenses, being at the rate of 58 per cent. of winners, on the entries. In the Order of Merit, based on the honors won, for the number of exhibitors from each nation, the following is the position, taking 100 as a standard: the United States score 88, Belgium 82, Austria 77, England and Hungary 72, Denmark, Norway, and Russia 67, France and Holland 50. But of the 32 gold medals, England has obtained 10, the United States 4, and France 15. The threshing machines shown by England, France, the United States and Russia, were very superior,—the American ploughs were magnificent, and were distinguished by careful workmanship, solidity and form, united to cheapness; in addition many of the implements were very ingenious. The general display of reapers and mowers was most excellent, and the day cannot be distant when the "perfect harvester" must appear.

What may be called the "Dairy Congress" held at the Trocadero was interesting, and treated chiefly on the preparation of butter; the feeling seemed to incline towards the Scandanavian plan of churning at low temperatures, which economises time, ensures the butter keeping better, and secures its aroma; if the process has failed, such is the consequence of not following correctly the system. An observation was made, that much of the difference existing as to the richness of milk in fatty matters resulted from bad instruments made to measure the quality and that lactometers were very defective. A prize is to be offered to the inventor of an instrument for testing the presence of margarine, and other matters employed for adulterating butter, and which it seems enter largely into the butters exported or sold in large towns. Margarine sells for one-third the price of average butter, hence the profits must be enormous. In Paris, there are establishments specially devoted to the sale of margarine, and have the air of model dairies, or of such as Marie Antoinette conducted, personally, at the Trianon.

A farmer has noted that when he covered a strip of loamy soil with a slight layer of river sand, the soil beneath was markedly fresh and moist, and patronised by worms, while at the sides, the soil uncovered was nearly as hard as a rock. The reason is simply owing to the sand acting as a screen, preventing the sun's rays from evaporating the moisture, the surface being thus kept humid, no water ascends from the subsoil by means of capillary action. The same effect is produced, and often beneficially, despite the loss in ammonia, when farm-yard manure is applied on the surface of the soil and never turned in.

There are a few annexes of the Exhibition devoted to commercial manures—to what may be called the scientific results of agriculture. There are companies and private fabricants who have seemingly an endless collection of fertilisers. It is the practical triumph of chemistry which, discovering the secrets, more or less complete, of the fecundity of soils and the necessities of vegetation, has acted accordingly. Science, as Liebig has well said, either approves or invalidates the conclusions of practice. There are exhibited even special fertilisers for kitchen and flower gardens. What progress since the seventeenth century for France, when a royal decree directed that the mud of Paris, its night soil, and the offal of the slaughter houses, were not to be employed as manures till they had rested three years in a common pit! It was Lavoisier who may be said to have found agricultural chemistry, or what is summarily known now as "agronomical stations," where the laboratory is in connection with field experiments. The Revolution swept away Lavoisier and his laboratory. Boursingault took up his idea, and effected some valuable experiments, though in a private capacity; Germany followed up his discoveries, and at once took the lead in establishing agronomical stations, above all, controlling the sales of commercial manures, as the chemist has the right to enter the factory when he pleases, and select samples for analysis, nay more, the farmer even after purchasing has the right to select his sample and have it gratituously analysed. France quickly followed in the wake of Germany, and has now no less than 80 "stations," the chief being at noted scientists; he executes analyses for the universe at large. The station at Anas is famed for its study of the cultivation of beet, in connection with the production of sugar and of alcohol. It is at this farm that M. Pagnoul has been able to formulate laws as to the action of nitrates on beet. The root is best suited for the sugar fabricant when the plant grows rapidly in the first three months of its vegetation: the nitrates then pass into the leaves and stimulate development, now, if the latter takes placed markedly only in a warm and humid autumn, fresh rootlets are thrown out, the nitrates and ammoniacal sulphates, instead of being gradually worked up, rapidly concentrate in the bulb, and produce disastrous results on the yield of sugar.

The distilling apparatus of M. Champonnois has received a grand medal, and the inventor himself has been decorated. It is suited to ordinary farms, and enables the sugar of the beet to be extracted and converted into alcohol, the residual matters being left for feeding purposes. The alcohol is exported, and the pulp remains for conversion into meat, milk, and manure.

The yield of beet in France this year, and the same remark applies to Germany, is now known to be inferior to that of 1877. Germany had 260 sugar factories in full work during September. The selling of the beet according to the relative density of the juice is making way in France, and promises to become general; it will protect both the farmer and the manufacturer, and will above all, give the death-blow of the employment of nitrates late in the season.

The Indian Agriculturist.

CALCUTTA, JANUARY 1, 1879.

TEA PRODUCTION IN ASIA.

It is scarcely more than a decade since China had the monopoly of providing the world with the "cup that cheers but not inebriates"; the change that has since taken place with regard to the sources from which the world now draws its supply of this important article of commerce, has been so great, and has been so vital in developing the resources of India, that a review of the present state of tea production in Asia, will have a more than passing interest to our readers. China has lost its monopoly and India and Japan have now entered into the field as considerable factors, increasing the world's supply of tea. Their teas are now influencing greatly the European and American tea marts, and it seems as if the China tea trade had reached its maximum in 1875, and is beginning to give way gradually to its younger and more vigorous rivals. As in India so in Japan, tea is now one of the staple products, and as the area of tea cultivation in those two countries is yearly increasing, the interests vested in the China tea trade are seriously threatened.

The official returns show the export of China tea from the treaty ports to have been

In 1874.

		Piculs*	Value. H. Taels†
Black Tea	... ...	1,444,249	31,193,858
Green Tea	... ...	212,833	4,724,464
Brick Tea	... ...	74,791	891,181
Dust Tea	... ...	3,504	16,508
Total	...	1,735,377	36,826,011

In 1875.

		Piculs	Value. H. Taels
Black Tea	... ...	1,438,611	29,739,793
Green Tea	... ...	210,281	4,965,480
Brick Tea	... ...	166,900	1,976,448
Dust Tea	... ...	2,594	15,791
Total	...	1,818,386	36,697,512

* About 120lbs.

In 1876.

	Piculs	Value. H. Taels.
Black Tea	1,415,349	30,159,983
Green Tea	189,714	4,641,691
Brick Tea	153,951	1,819,483
Dust Tea	3,799	26,769
Total ...	1,762,813	36,647,926

During the last six years the exports from China amounted in quantity and value to

				£	
1871 ...	203·0	million lbs.,	value	12	millions.
1872 ...	214·4	"	"	13½	"
1873 ...	195·6	"	"	2	"
1874 ..	210·0	"	"	11¼	"
1875 ...	220·0	"	"	11 1/5	"
1876 ...	213·3	"	"	11	"

To this must be added the exports by caravans to Eastern Europe, to Siberia and to the districts north of the Himalayas, which amounted in 1876 to 152,000 piculs. The yearly home consumption of tea in China has been estimated at two-thirds of the total production, the exports at one-third, so that China must have produced in 1876 more than 600 million lbs. of tea.

Europe absorbs now nearly the whole of the tea exported from China, Chinese tea having, in the American markets, been almost entirely superseded by Japanese tea. The trade is chiefly in the hands of English merchants and is likely to remain so, as the United Kingdom alone consumes more than half the exports—during the year 1876, 125 million lbs. We stated that the year 1875 has probably seen the height of the Chinese tea trade. In 1876, for the first time in the annals of the trade, did the quantity of tea exported from China remain stationary, though the consumption, in Great Britain alone, increased by 5,000,000lbs., the excess being entirely drawn from India. During 1877-78 the exports from China to Great Britain and the Continent were twelve million lbs. less than during 1876-77. Indian and Japanese tea, the former in England, the latter in America, are coming into greater favour day by day among the consuming classes and it is therefore only reasonable to expect a considerable decline in the Chinese tea trade, and a corresponding increase of that of its competitors. Ceylon is also entering the list, and will, in less than a decade, figure probably as a not unimportant exporter of high class teas, large areas of available and suitable land being now taken up in that island for its cultivation. The inferiority of the bulk of Chinese teas is of course the chief reason of their being supplanted by the superior Indian and Japanese teas, whose superiority lies not so much in their innate qualities, as in the more skilful manufacture. The great competition among European merchants in China has a great deal to do with this deterioration. Every firm endeavours to obtain the first shipment and pressure is brought to bear upon middlemen and by them upon the growers, who pluck the leaf often before it is fit for plucking, and all the ensuing processes of manufacture are conducted with such carelessness, that it is surprising the result is not worse. The firing of the leaf, for instance, takes place several days, generally one or two weeks, and often a month or so, after the leaf is plucked; the merest tyro in tea manufacture knows how necessary it is, to fire the leaf as soon as possible after the plucking. Consul Medhurst's report on the Chinese tea trade deals with this subject in detail, and he is of opinion that nothing but the introduction of European capital and enterprise can save the tea trade from decay.

We have on more than one occasion drawn attention to the extraordinary growth of the Indian tea industry, which we may say, has surprised the whole world, and is a striking and creditable example of what Anglo-Saxon capital and energy is capable of. In 1851 the exports of Indian tea from Calcutta, amounted to 262,839lbs., in 1877 we exported 31,784,000lbs.

The area of cultivation in Assam, Bengal, North-West Provinces and Madras is still (though now more gradually) increasing, and the quality of tea, though it lost considerably in repute during the last year, has during the present year fully recovered its high character. Fifteen years ago tea cultivation in India was looked upon as a doubtful experiment; it is now an important industry, in which vast capital and European energy is engaged. The following statistics show what enormous strides the industry has made.

Exports of Indian Tea to England.

During the year 1860	... ...	1·4 million lbs.
" 1865	... ...	2·7 "
" 1870	... ...	13·2 "
" 1871	... ...	16·4 "
" 1872	... ...	17·9 "
" 1873	... ...	19·7 "
" 1874	... ...	23·3 "
" 1875	... ...	26 1 "
" 1876	... ...	29·4 "
" 1877	... ...	31·7 "

The consumption of Indian tea in Great Britain compares with that of Chinese tea in the ratio of the relative quantity imported. The ratio of the imports of Indian tea to that of Chinese tea stands :—

In	1872	as 1	to	9·7
"	1873	" 1	"	7·4
"	1874	" 1	"	7·5
"	1875	" 1	"	6·7
"	1876	" 1	"	5·6
"	1877	" 1	"	5·5

The tea industry in Japan has likewise increased in importance, though its growth has been slow, compared to the Indian tea industry. After a standstill during the seasons 1871-73, followed a rapid extension during the season 1873-74 until 1875-76. Previous to 1873, the total exports from Japan amounted on an average to 12·5 million lbs., rising even under the most favourable circumstances never higher than 18 millions, while the quantity manufactured for export during the ensuing years was :—

Season 1873-74...	... ...	19,816,000 lbs.
" 1874-75...	... ...	24,976,000 "
" 1875-76...	... ...	29,326,000 "
" 1876-77...	... ...	24,722,000 "

The demand for this tea in the American markets, the improvement of communications in the interior of Japan, the development of its export trade and the opening of its chief ports, have done much to develop this industry in Japan. There was a serious falling off in quality in 1876-77, which we noticed at the time, said to be due chiefly to the carelessness of the growers and manufacturers; the losses which were incurred during that season, owing to the great fall in prices must have been a severe lesson, and we hear the tea of season 1877-78 better spoken of. The actual exports from the chief ports in Japan were :—

	1874-75	1875-76	1876-77.
From Yokahama ...	16,547,375	18,885,743	16,177,272 lbs.
" Hiogo ...	4,292,159	6,080,036	6,520,527 "
" Nagasake ...	1,043,704	1,060,000	987,817 "
Total ...	21,883,238	26,027,779	23,685,616

Nearly the whole of this went to the American markets, only small parcels aggregating 400,000 to 500,000lbs. being shipped to London. The consumption of tea in the island is said to amount to nearly 4 million lbs., which has

to be added to the export in order to get the total production of Japan.

China, India and Japan are the principal tea producing countries in Asia, though Ceylon and Java are also likely to become of importance as such during the next decade, about 3,000 acres being now under tea in Ceylon and this area is being rapidly added to. From Java the exports of tea were in 1873 valued at 2,400,000 florins, in 1874 at 2,700,000 florins,—quantity not ascertainable.

The total production of tea in Asia for export, may therefore be estimated as amounting now to 280 million lbs.

ADVANTAGES OF REDUCED ACREAGE.

ON page 428 of this year's *Agriculturist*, Colonel Vertue makes a suggestion which seems to us worthy of being followed up. Colonel Vertue advocates that ryots should be encouraged to plant a smaller area, but to spend as much labour and manure on that smaller area as they did on the larger. This seems to us a valuable and practicable suggestion and is within the reach of all.

Let us suppose a ryot, who usually cultivates 50 acres and who spends Rs. 24 per acre, this represents Rs. 1,200, including of course value of his own and his bullocks' labour, well let him spend this Rs. 1,200 still, but let him only cultivate 30 acres. There will be a saving in seed, namely the seed that would have been used on the abandoned 20 acres. The 20 acres not being required for cultivation, will be left fallow, and may be profitably used for cattle grazing purposes, grazing land being much wanted, as the breed of cattle is rapidly deteriorating all over the land, on account of, among other causes, want of proper grazing. There will be likewise a saving in irrigating expenses and in fencing and in having to watch a smaller extent of country as crops ripen. Each acre will under this system cost, say Rs. 40 to cultivate instead of Rs. 24, the difference Rs. 16 being expended on the land in deeper cultivation and in manuring, and doubtless the result will be a larger amount of grain from the 30 acres, than was formerly obtained from the 50 acres, with less trouble in many ways.

The only difficulties in the way of this reform are prejudice and indifference; naturally the ryot prefers to follow in his forefather's foot steps, but this will be the only real difficulty. He is stubborn, but somehow he looks earnestly to his own interest; if we can only penetrate his prejudice and shew him where that interest lies. The question is then, how is he to be led to see, that this change will be for his advantage, without at the same time interfering too much with his time honored habits—call them prejudices if you will. Model farms will not do it, for they have proved to be an unsuitable medium of instructing the ryot. Their career has not been of such a nature as to induce him to follow the bent of their teaching or rather leading. True, they have raised larger crops as one result of their experiments, and the crops produced have been superior in point of grain and straw, but the cost has been out of all proportion to the result. It must be acknowledged that the ryots look upon these farms as decided failures, and we confess they are amply justified in many instances, in so regarding them.

But Government has otherwise ample means at its disposal to try this experiment. The estates under the Court of Wards will be found most suitable for this purpose. Let the manager of these estates select four intelligent ryots—and ask them to try the experiment on small plots of about four acres each, at the same time guaranteeing them against actual loss. This would not lead to an extensive risk on the part of estate, and would give the experimentalists confidence. Steps would have to be taken of course to see that extra labour and manure were actually expended, and we feel convinced that the second year would shew highly satisfactory results. Granting this the ryot might then be left to himself to follow it up, and this he would do, as self-interest is the spur that will push him on if anything will.

AGRICULTURAL EDUCATION IN THE BOMBAY PRESIDENCY.

ADVERTING, in our issue of October 1877, to the great success that has attended the establishment of agricultural schools and colleges in Europe and America, and the great national benefit that is now derived from the spread of agricultural education in these countries, we urged Government to initiate throughout the country a similar movement, adapted to the peculiar circumstances in which the Indian agriculturist is situated. We wanted to see, we said on that occasion, agricultural colleges, one in each Presidency, agricultural schools in the districts; we desired, we said, the science and practice of modern agriculture taught, not only learnedly in Colleges and High Schools, but also modestly in every village.

We rejoice therefore, to be able to record to-day the resolution of the Bombay Government, published elsewhere, to make a beginning at once in the direction we pointed out. Often as the claims of Indian agriculture for improvement have been acknowledged by the Government of India, they have never as yet been met by such a practical scheme as that which has been matured by His Excellency Sir Richard Temple, and if this scheme is carried out in the form proposed in the resolution—and in that case we are certain of its success and of the great benefit it will confer upon the agricultural classes—then Sir Richard Temple will have cause to be proud of having been the mover in establishing a simple, and yet complete system of agricultural education suited to our peculiar circumstances. There is no greater benefit that can be conferred upon the vast rural population of India than an improved system of agriculture; and there are no better means by which this great goal can sooner be reached than a system of agricultural education that reaches down to the village school. Sir Richard Temple's proposals embrace the establishment of an Agricultural College in connection with the Civil Engineering College at Poonawith the ultimate view of establishing another College in Guzerat, the garden of Western India. A study of three years will prepare the student to go up to the Bombay University for an Agricultural Degree, and what is most important, native appointments in the Revenue Departments, as Mamlatdars, Mahalkaries Karkoons, &c., will preferably be given to those who have thus graduated, if it cannot be arranged that all these officials shall in future be drawn from graduates in agriculture.

To feed the College class, six agricultural classes will be established in connection with High Schools; three of these are to be in Guzerat, one in Khandeish and the others in the Deccan. The teachers are to be drawn from the agricultural students who will pass successfully and will have completed a three years' curriculum, in June next, at the agricultural institution at Sydapet. The Poona College is to supply in future the teachers for the High Schools, and when a sufficient number is available, they will be utilised as teachers of elementary agriculture in vernacular and village schools. It will be seen therefore that the scheme is well matured and complete and the only doubt

left in our mind is, whether it can be put in force at no greater yearly expenditure than £1,500, a ridiculously small sum surely for such an important branch of education. However we wish Sir Richard Temple every success, and thank him for having moved out of the accustomed groove. The resolution, if carried into effect with the same spirit that penned it, will mark an era in the history of our administration of India.

EDITORIAL NOTES.

As an instance of what improved cultivation can do, we give prominence to the following results obtained in the district of Dehra Doon, where tea has not yet had fair play, except in very rare instances, we may say, in one instance only—and that case shews results that may fairly be considered most satisfactory and conclusive. The general rule of working there has been and still is, to have the cultivation carried on at the least possible cost. One would almost think the object in view was not to develop the plant, but simply to prevent the land from lapsing back to primitive jungle. But one company has gone out of the beaten track, and has for some years been encouraging a liberal expenditure on its gardens, with the result of obtaining 440lbs. of Tea per acre in 1877, and over 500lbs. during the season just closed, whereas the run of outturn in the Doon is from 150lbs. to 300lbs, 240lbs. or 3 maunds per acre being a liberal average. Allowing the excess yield in this case to have been 240lbs. per acre, this would represent an additional return of Rs. 150 per acre, which pays thrice over for the extra cultivation.

We regret to hear that it has been decided to abolish the Bangalore Experimental Farm. This move appears to be the result of an unreasoning fit of economy. Besides the Superintendent himself, there are only a few coolies, and several convicts on the establishment, yet, in spite of all these drawbacks and difficulties, Mr. Harman has rendered the Farm quite a success, as the last annual report shews. Now, after the lapse of fully three years, and an expenditure of Rs. 80,000 upon it, the Farm is to be abolished. It is stated on good authority that the abandonment of agricultural reform operations did not emanate from Mr. Gordon, the Chief Commissioner. His proposal was to abandon the Bangalore Farm, and start a more central one in Mysore. The Viceroy and his advisers, however, do not seem to believe in improvement in agriculture as a preventive of Indian famines. So the Farm is doomed. There is yet, possibly, some hope that the ryots' thirst for agricultural knowledge will be satisfied. Mr. Caird, C. B., of the Famine Commission, is now on a tour through the northern districts of India, and may probably visit Madras and Mysore. It is believed that Mr. Caird is strongly in support of agricultural reform as a means of preventing the recurrence of famines.

A contemporary tells us that the Chemical Laboratory attached to the Agricultural College at Sydapet, is now completed. It is a substantial building, including verandah, about 80 feet by 40, and about 20 feet in height. It is well ventilated and affords accommodation for thirty students working at one time, and private accommodation for the chemical lecturer is being fitted up. The chemical apparatus, fittings, &c., have just been received from the Secretary of State for India. The College building, which has long been most urgently needed, has, at length, been sanctioned for immediate commencement. It is to be a two-storied building with a tower at one end. The ground floor, however, is only to be taken in hand at present. This consists of a lecture theatre 30 feet wide and 50 feet long, with terraced seating; a lecture room, 25 feet wide and 40 feet long; and three class rooms, each 20 feet by 25 feet. The rooms will be lofty and well ventilated. The whole of the building is to be surrounded by a wide verandah. The upper floor will provide similar accommodation to the ground floor. There are now two classes at work in the College, each consisting of about thirty members, or about sixty in all. In addition, a course of lectures on Agriculture is being delivered by Mr. Benson at the Normal School to a class of about twenty-five students. So Madras has a good start ahead of Bombay, and should make strenuous efforts to maintain her supremacy in this respect.

An Agricultural Exhibition is to be held at Burdwan on the 27th of January next, and four following days; and to judge from the handsome prizes offered and the liberal treatment which the committee extend to exhibitors, the Exhibition will deserve, if it does not command, success. The prizes are divided into three classes—those for residents of the Burdwan district, those for residents in the Burdwan division, and those for all-comers. Department I includes cattle, horses, and donkeys, sheep and goats, poultry, wild animals, and dairy produce. Department II includes implements. Department III agricultural produce and raw materials; and Department IV brass and kansa work. In the first, prizes will be given amounting to Rs. 1,100, in the second to Rs. 1,000, in the third to Rs. 1,000, and in the fourth to Rs. 1,000. But in addition to the money prizes, every winner of a first prize will receive a silver medal, and instead of money, winners of more than Rs. 20 in value can have a cup, with a suitable inscription on it, should they prefer it. All necessary arrangements for the convenience of exhibitors will be made by the committee, if communicated with, and all intending exhibitors should communicate with the Secretaries before the 5th of January. The Exhibition ought to be a success.

We have received the prospectus of a new banking institution to be called the "Rohilkund and Kumaon Bank" which it is intended to start early this year, with a capital of Rs. 1,00,000 with power to increase. The head office is to be at Naini Tal or Bareilly, The Bank has good prospects we think, and from our knowledge of Mr. Lancaster in particular, we can honestly commend the project to the public. One must have been in the North-West, to understand how great a public convenience these small local Banks really are. The great crying want of the Mofussil moreover, is capital to set the springs of industry in motion. A net-work of such banks spread all over the Mofussil, might we think if wisely assisted by the State, be made an important step towards improving the agriculture of the people, by assisting them with small loans after the fashion of the old Scotch banks. The circumstances of the country demand original statesmanship, but where to look for it, we do not know. The finance department and its Minister are absorbed with the task of making both ends meet, and with the mere routine of book-keeping estimates, and audits. Never surely was there a time at which, nor a people for which, so much required to be done by private enterprise to assist the State. It would be true wisdom we think, and statesmanship for the Government itself to show an interest in these small local banks, assisting them, if necessary, with the means to make the *taccavee* advances to the cultivators that were so common under native rule.

It is most difficult for the State to make those advances directly, but we cannot but think that wherever one of these small local banks exists, it should be made a sort of centre, or heart, for circulating money amongst the cultivators, and reducing the rates of interest that now strangle the life out of the people. We wish twenty such banks were starting instead of one *only*; but then we should look to make something more of them, than a mere convenience to *English residents in the Mofussil, and the tea-planters* of the Himalayan valleys. General Strachey will tell us, and truthfully, that *he* has no time to attend to such suggestions. It is none the less our duty and vocation to make them. We have made a good many suggestions at intervals that time has shewn to be valuable, and we cast this "bread upon the waters" once more to be found perhaps after many days.

Dr. J. König, has recently published the results of his investigation into the composition of ground rice-husks, which appear to have been strongly recommended in some quarters as a valuable food for cattle. He finds the meal to contain 8·91 per cent. of water, 2·75 of protein, 1·19 of fat, 26·14 of non-nitrogenous extractive matter, 45 15 of woody fibre, and 15 85 per cent. of ash

The nutritive value of such a woody mass as this, he reports hardly equals that of straw or chaff.

THE *Tea Gazette* in its first issue of December has a most extraordinary leading article on "Mineral Manures." We see sulphate of iron or copperas, advocated as a manure, a Chemical that is poison to vegetable life. The *Tea Gazette* speaks further of it as an insoluble compound, while it is easily soluble in water; it speaks of salts of phosphorus and salts of nitrogen, which we have not as yet heard of, and classes nitrogen as a mineral substance. How are we to account for such blundering in the leading columns of a professedly scientific journal?

THE Neilgherry newspaper reports that a small consignment of Ceara rubber plants (*Manihot Glaziovii Muell*) have just been received from Kew. Of these 53 were sent to the Nelambur teak plantations to be reared under the care of Mr. Ferguson, and 34 are in the hot-house of the Government Gardens at Ootacamund, under the personal supervision of the Superintendent. The ultimate home for these latter is a ravine at the foot of the Kotagherry ghaut, originally prepared for the growth of Mahogany, and perhaps a couple will be tried at Burliar. Referring to this species, Colonel Beddome observes: "This Ceara has a succulent, weak-looking stem, rather suggestive of a soft wooded shrub or creeper than a tree. It is apparently a new species of Manihot, and not mentioned in the latest books on the order to which it belongs (Euphorbiaceæ), and looks as if it would grow readily from cuttings." A few plants are also to be supplied to the Superintendent Government Farm, and to the Secretary of the Agri-Horticultural Society, Madras.

FOR some time past, as our readers are aware, the Maharajah of Cashmere has given considerable attention to the development of an industry in the growing and reeling of silk, to cover to some extent the losses occasioned by the depression in the shawl trade. The efforts made have been fairly successful so far, samples of raw silk sent to England for valuation having been reported superior to Bengal, and approaching Italian silk in quality. The progress of the industry has, however, we are sorry to hear, received a severe check,—an epidemic disease having killed off most of the worms, and this season there are no eggs to breed from. The whole thing must be re-commenced. The climate is well adapted to the cultivation of silk; much perseverance and public spirit had been shown by the Maharajah's officials in creating and fostering a new industry.

IN many of the southern governments of the Russian Empire, where the accumulated droppings of the countless herds upon the steppes and plains cannot be remuneratively employed as manure for the land, they are put to profitable use in the preparation of a form of fuel, known as "kizjak," which is largely consumed in the winter months by the peasantry and smaller farmers. This kizjak occurs in the form of bricks, similar to those of peat, and so met with as an ordinary article of commerce in at least seventeen governments of the Empire. Its manufacture dates from the year 1844 only, when the system of employing the waste manure, now so general, was introduced into the Government of Orenburg by a Cossack Major named Podurow. The price of kizjak varies in the different provinces where it is used, according to quality and the local demand for it, from 1½ rouble to as much as 20 roubles per 1,000 bricks. As regards its heating power, it naturally occupies a low place in the scale as compared with many other substances, and it is generally calculated that for the production of a certain amount of caloric about three times as much of good kizjak is required as of ordinary coal. Two chief varieties of kizjak are met with in commerce, respectively prepared from horse dung (Loschadiji kizjak) and sheep dung (Owtschiji kizjak). The relative value of these as fuel depends, of course, on their chemical composition. That of an average sample of each kind may be taken as follows:—Horse kizjak: carbon, 41·386; hydrogen, 4·985; oxygen, 33·396, nitrogen 1·073; salts and earthy admixtures, 18·530 per cent. Sheep kizjak: Carbon, 28·690; hydrogen, 3·785; oxygen, 27·990; nitrogen, 1·907; salts and earthy admixtures, 37·630 per cent. In preparing either sort, the dung that has been collected over winter is spread out in thin layers on the ground, sprinkled plentifully with water, and then trodden down by horses. The paste thus made is pressed into wooden forms, like brick moulds, and then placed in the open air to dry. Occasionally the kneading process by horses is omitted, but the bricks are then apt to crumble to pieces.

IT is stated that a present to the Maharajah of Cashmere of some samples of the Cuzco maize seed, sent out from England by the Secretary of State, was forwarded, some time ago, by the India Government to His Highness for experimental cultivation in Cashmere.

WE noticed in our last issue the inferiority of the potato now produced in the Punjab hills to that once grown there. The tuber seems to have deteriorated throughout India. The Neilgherry paper says: "The glory of our Kulhutty potato has also departed. But the cultivation of this popular tuber is very general now in the villages of this district. The authorities cannot do better than distribute fresh seed among growers. A year ago, a quantity of potatoes grown in the Ootacamund Government gardens was distributed among a few Burghers and Canarese vegetable gardeners—but the tubers failed to germinate freely; whether from climatic influences or from other causes they rotted in the ground. The potatoes now brought to market are better, but still much disease is prevalent."

A CORRESPONDENT of the *Brewers' Guardian* says that maize has been successfully malted, and that beer or porter brewed from one-third maize, and two-thirds barley-malt is equal in every respect if properly brewed, to that made from barley malt alone, and is more full to the taste.

THE suitability of the soil of Perak for planting enterprise seems to be exciting more and more attention every day. We read that five or six more planters from Ceylon are now in the State examining its soil. Johore also is following suit. The Maharajah has offered Mr. Buchan, Private Secretary of the Governor of Ceylon, and formerly a planter, £1,000 a year to become a sort of Minister of Lands for Johore, and he is expected there in the beginning of this year, accompanied by four or five more planters, to explore the territory.

OUR Ootacamund contemporary lately suggested that as barley does so well on the Neilgherries, a quantity of fresh seed should be procured and distributed among the Burghers; this we are now told has been done. The present proprietor of the Castle Brewery gratuitously distributed 1,000 bushels of seed barley among the Burghers of the Arvanghat valley, in the early part of the year. The only condition imposed was that the produce should be sold to the brewery at a rate agreed upon. The Burghers, however, consumed the produce of their fields, and excused their breach of contract on the score of the prevailing scarcity. It is, however, not unlikely that some portion of the grain has been preserved for future sowing, and that at a future time, the proprietor of the brewery will be rewarded for his liberality.

A REMARKABLE instance of spontaneous combustion is afforded by a correspondent of a scientific contemporary, in which a house in Caracas narrowly escaped being set on fire through the sudden outburst of flame from a large wasps' nest in a closet under the roof. Although the weather was intensely hot, the position of the nest, under a roof composed of tiles and thick layers of earth, was such as to preclude the possibility of the fire having originated through solar heat. Suddenly thick smoke was observed to issue from the closet; and, had not immediate steps been taken to arrest the spread of the fire, a serious conflagration might have resulted from the combustible nature of the wax-cells of the nest. Similar occurrences are described as being very frequently observed in Venezuela. The temperature of bees' nests or hives is known to be very high, frequently reaching 38 degs. Centigrade or 100 degs. Fahr., being considerably more than the normal temperature of the human body. The variety of honey-collecting insect known as melipone, whose nest resembles that of the wasp, is common in Central America and the northern parts of South America, and it

is probable that their nests have frequently been taken for the nest of the wasp. The phenomenon is probably caused by some chemical change in the constituents of the nest under the influence of the high temperature, and it is possible that the same danger would await the nest of the ordinary hive-bee under favourable circumstances. The point is worth further investigation in temperate as well as torrid climates; and bee-keepers may both draw as practical a lesson from the facts related in connection with the regulation of the temperature of their hives.

A NEW process of obtaining the saccharine juice from the sugarcane has lately been invented by a Mr. A Bonnefin, of Mauritius, who endeavoured, without success, to get his invention taken up in the island. He then went to England, and has succeeded in selling his process to a Company for £32,000. The principal feature of the invention appears to be that the canes, instead of being passed entire through the crushing rollers, are first sawn up by vertical and horizontal saws into very small pieces, the result of which is said to be that not only is the power required to make a given quantity of sugar reduced by three-fourths, but, moreover, there is hardly any juice left in the cane trash. It is well known that the loss of juice in the "bagassee," or cane trash, has hitherto been very large; and it seems, by the new process, to be reduced to a minimum.

THE value of English drills in this country has been abundantly proved at the Mysore Experimental Farm. Seed can be sown in rows at any depth, and at any required distance apart. The quantity sown can, also, be regulated. And a rapid effective surface cultivation can easily be given after the crop is above ground by means of hoes and scuffles drawn by bullock-power and by hand-hoeing. The Japanese have adopted all the English implements of agriculture, but an English plough is a novelty in India and an English drill a curiosity.

A SUBSTANCE having the properties of India-rubber and gutta percha has been derived of late from the bully tree, on the banks of the Amazon and Orinoco. It is called balata. It is tasteless, gives out an agreeable odour on being warmed, may be cut like gutta percha, is tough and leathery, is remarkably flexible, and far more elastic than its rivals. It becomes strongly electrified by friction, and is a better insulator of heat and electricity than gutta percha.

MR. PEREIRA, Sur Ameen of Bangalore, in a letter to the President of the Municipality, points out that poisoning by datura is alarmingly on the increase, there having been no less than seven cases detected in November, and, judging by the apathy of the Police, this number must represent but a fraction of the actual number of cases. Datura grows wild all over the cantonment of Bangalore. Mr. Pereira observes that there are two species,—the *black* and the *green datura*. The apple of the datura contains upwards of 300 seeds, one of which is enough to stupefy a grown up person. A person who has been drugged with *datura* remains insensible for several days, which of course lessens the chances of detecting the poisoner. Mr. Pereira suggests therefore that the Municipality should undertake the destruction of the *datura* plant in Bangalore, and make it penal for any one to grow, or sell, or be found in possession of *datura*.

MR. T. SMITH (Newry, England) writes concerning the Elymus Glaucus:—"Allow me to speak a word of praise for this really distinct and useful grass. In colour it is quite unlike any other, being bluish green, and it extends itself freely in every direction. It succeeds both in wet and dry places; in fact, it seems to grow any where; and ultimately it becomes a densely matted mass from two feet to three feet high. I may add, too, that, in addition to its value from a decorative point of view, it makes a first-rate corner plant."

THE leaves of plants, considered in reference to their action on gases, fulfil two distinct functions. By their protoplasm or nitrogenous contents they absorb oxygen, and they give out constantly carbonic dioxide (carbonic acid). By their green colouring substance or chlorophyll they inspire, during the day only, carbonic dioxide gas, and expire oxygen. In the young state the protoplasm predominates, the chlorophyll is relatively scanty; hence during the period the respiratory function predominates over the assimilating function, and consequently the leaves exhale carbonic dioxide at this stage without interruption. As the leaves increase in size the protoplasm diminishes, the chlorophyll augments, consequently the capacity of emitting carbonic acid during the day rapidly diminishes, and soon they give off nothing but oxygen. From this time forth it is only by placing the plants in darkness, or by more or less suspending the action of the chlorophyll, that it is possible to demonstrate the effect of respiration. There is, then, for living beings, plants, or animals, only one kind of respiration—the same for all. The office of the chlorophyll is different, its work is one of assimilation. Such are the conclusions to which M. Corenwinder arrives in a recent number of the *Annales Agronomique*, after detailing some new experiments made by him, and summarising old ones. The views advocated by M. Corenwinder, based indeed to a very large extent on M. Corenwinder's own experiments, are now adopted in all our standard text-books; and if the contrary is still taught in so-called popular books and by ill-taught popular lecturers, it is only because the filtration of new ideas takes time. M. Corenwinder may rest assured that views are accepted by the great majority of those whose opinion would be appreciated by him.

FROM the annual report on the Nicobar Islands for 1876-77, we learn that some interesting agricultural experiments were made during the year. Arrowroot was cultivated and manufactured, but owing to the want of clear water for washing the produce, it was not considered fit for the Calcutta market. Three hundred and sixty-two bighas were planted with coffee, which promised well. A few plants of vanilla were received from Calcutta, three of which survived and grew well, and twenty cuttings taken from them struck root and were thriving. Indigo was tried, but the seed, owing probably to accidental causes, did not germinate.

THE last exotic spice which has been acclimated in California is the ginger plant. At Santa Clara the plant is growing thriftily. It resembles the corn stalk in size and appearance but unlike corn, yields a blossom. From the root is made the valuable product, Jamaica Ginger.

AN Alsace-Lorraine agricultural journal gives the following description of a method of preparing potatoes for long keeping, which is largely practised in many parts of France. A large kettle or boiler of water being placed over the fire, and its contents raised to boiling point, the potatoes, previously well washed, are placed, a few at a time, in small baskets or nets, which are then rapidly thrust under water and there retained for about four seconds. Of course, the introduction of so considerable a bulk of cold matter lowers the temperature of the water somewhat, and care must be taken that it rises to the boiling point again after each immersion before a fresh netful of potatoes is introduced. As each batch is withdrawn it must be shaken, and spread out on the flooring to dry in some well-aired place. When all the stock has thus been treated, and is thoroughly dry, it should be stored away in some dark room, of course free from damp. The potatoes will be found to have lost all tendency to germination, and will remain sound and well-flavoured till the next year's crop comes in.

COMMUNICATED AND SELECTED.

AGRICULTURAL EDUCATION IN THE BOMBAY PRESIDENCY.

THE Governor of Bombay in Council directs the publication of the following papers regarding Agricultural Education, for the information of all concerned. His Excellency in Council earnestly requests the co-operation of all officers and of the Native community in the furtherance of this important cause.

Minute by the Governor of Bombay, dated 29th October 1878.

I.—The need of agricultural science in this country, the backwardness of the people in the superior methods of culture, the slow deterioration of the soil in many places from exhaustive processes, the want of restorative means and appliances, the probability that by improved husbandry the yield of the soil could be augmented,—are considerations so manifestly important that no apology is needed, when I ask my honourable colleagues to join me in pressing them upon the attention of all concerned. Nor need I at all dilate upon them, as they are so well known to, and so fully appreciated by, my honourable colleagues.

2. Referring to paragraph 5 of Minute of the 8th September, regarding the formation of a class at Poona for training natives in scientific agriculture,—in which my honourable colleagues concurred,—I have now to mention that Mr. W. R. Robertson (Superintendent of the Agricultural Institute at Sydapet near Madras) has arrived at Poona and conferred with me and with Dr. Cooke, Principal of the Civil Engineering College at Poona on the whole subject of education in scientific agriculture. I have accordingly to state for the consideration of my honourable colleagues the conclusions to which we have come provisionally.

3. Despite the superior local advantages, respecting the productiveness of agriculture and the enterprising character of the people, which Guzerat possesses as compared with the Deccan, I find that Poona is clearly the best place for the establishment of an Agricultural College. I bear in mind that the people of Ahmedabad are anxious that such a College should be established at that city. We do not, however, at present possess the means in Guzerat, whereas we do possess them in Poona. Hereafter if the development of agricultural education shall enable us to establish a College in Guzerat, that will be well; meanwhile we must be content with making a commencement at Poona where the necessary facilities exist. At Poona alone have we at hand the scientific appliances and the teaching power for high education in agriculture. As already proposed in my Minute of the 8th September, the Civil Engineering College at Poona (which is fast developing into a College of Science) can make scientific agriculture one of its branches. The Committee, which my honourable colleagues concurred with me in appointing, have submitted their proposals, which will be found worthy of our approval, whereby only matriculated students will be admitted to the agricultural class. This class, then, will be strictly a College class, and its under-graduates will be qualifying themselves for the degrees which, we hope, the Bombay University will confer in scientific agriculture. In that case the University would fix the standard of examination. At this College will be preserved the high standard of agricultural education which students from the interior of the country may be expected to reach. Here will be placed the centre and the head of the system. From here will emanate the supervision which will be needed for whatever agricultural schools may be established in the various districts. The annual cost of the arrangement is estimated by the Committee at Rs. 6,000.

4. I may add that at Poona, veterinary instruction of the best kind can be afforded—indeed an excellent school of this kind already exists in the Cantonment.

5. In connection with the College at Poona, I propose, (if my honourable colleagues shall concur) to establish agricultural classes in some of the high schools in the several districts of the Presidency. This method will be comparatively cheap and easy: can be almost immediately carried out, and can be adapted to a very small number of students at the outset; whereas the setting of separate agricultural schools would be costly and difficult, would be beyond our means at present, and would be unsuitable if at the outset only a few students were to come forward. At a high school the students are taught English and the vernacular, also the ordinary kinds of elementary knowledge. Those among them who might be willing to attend an agricultural class could do so. Mr. Robertson thinks that one hour a-day for in-door agricultural instruction and one hour extra out of doors every other day would suffice. To that extent the students would have to be excused some of the ordinary subjects of study, the English and vernacular studies only being obligatory. After a two years course they might, in the opinion of Mr. Robertson and Dr. Cooke, receive "school certificates" of proficiency in agriculture on passing a moderate examination, which would be conducted by the Poona College. Such a certificate would *per se* be of use to a young man even if he went no further, but more particularly it would admit him to the agricultural class of the Poona College.

6. It will be remembered that to this class matriculated students will also be admitted and will be eligible for a University degree in agriculture. A certificated student of an agricultural school, as above described, will be admitted to the College class, indeed, but will not be eligible for a degree unless he passes the Matriculation Examination also. If he does not become eligible for a degree, he may, after a two years' course in the College, obtain a College certificate, which will have some considerable value; but will never be so valuable as a degree. It would be better, of course, that after having obtained his school certificate in agriculture, he should also pass the Matriculation Examination. But he may not be able to do so, and in that case he should not be debarred from the College instruction even though he may not be eligible for a degree.

7. The course for a degree will probably be determined by the University at three years. But Mr. Robertson and Dr. Cooke think that for a College certificate, as above described, a two years' course will suffice, as the students must necessarily have undergone a two years' agricultural course at the school.

8. The College then would have two sets of students—first, under-graduates going through a three years' course for a degree; second, students having school certificates and going through a two year's course for a College certificate. Young men belonging to either set will be most useful persons to the country in various capacities, official and non-official.

9. Dr. Cooke desires to open this class from the commencement of next session, that is, in November. No time, therefore, should be lost in sending round the requisite notices to the several high schools to inform intending students. The curriculum has been already proposed by the Committee above alluded to. The chemical course would be partly devoted to agricultural chemistry; the botanical course to agricultural botany; the geologic course to surface geology. For the agricultural course Dr. Cooke agrees with me in thinking that we may await the appearance of Mr. Robertson's text-book of agriculture to be issued very soon, which is based on the best English text-books, with special reference to the experience gained during several years in Southern India.

10. I revert to the organization of the agricultural classes in the high schools. It would be very desirable to open at least six such classes at various places; three of which classes might be in Guzerat, where the system is more likely to be immediately popular than anywhere else; one in Khandeish and the remainder in the Deccan. We know that many students in Guzerat are willing to come forward.

11. The first question is, whence are the teachers to be obtained? Now, fortunately, for some time past, many youths from the Bombay Presidency —chiefly Parsees—have been studying under Mr. Robertson at Sydapet, where they have nearly completed a three years' course. Mr. Robertson thinks that the best of them will, on completion of their course, be qualified to give elementary instruction in agriculture to school classes. For the six classes which we propose, then, six men would be required. After consulting Mr. Robertson, I propose that we offer each of the six young men whom he may select a salary of sixty rupees per mensem. And this would constitute the sole charge of establishment for the classes. Here, then, we have our teachers at hand. In future the Poona College will produce teachers.

12. The next question is, what shall be the curriculum? There again, fortunately, Mr. Robertson has a little book, almost quite ready, in English, on this very subject of elementary agriculture, called the agricultural class-book, based on the books published in England and adapted for the use of Indian schools after an experience of several years in Southern India. This book comprises elementary instruction in—

I. Soils.—Origin, formation, distribution, tillage.
II. Manure.—Varieties, action, uses.
III. Crops.—Varieties, culture, uses.
IV. Stock.—Races, breeeding, feeding, general management.
V. Implements.—Machines, tools, water-lifts.

As already seen these students must know English, therefore this book will suit them exactly. So much for the in door curriculum.

13. There remains the matter of the out-door curriculum, which is of primary importance with respect to agriculture. It is in the field that the students must practice the principles of which they have read in the agricultural class-book. For this purpose, Mr. Robertson thinks that at least six acres would be needed for each class; this area is a minimum; ten acres would be better; but as economy is essential, we must be content with a minimum to begin with. The six acres are made up thus—one acre would be wanted for ploughing deep and shallow; two acres for rotation of crops; one acre for exhibition of manure; one acre for irrigation; one acre for perennial crops as distinguished from annual crops. As near to the school as possible, then, six acres of land would have to be rented, for at least ten years, in order to give the experiments fair play; though a twenty year's lease would be better. Irrigable land would be preferable: but as just seen it would not be absolutely necessary that more than one acre out of the six should be irrigated; therefore the six acres may be unirrigated land if irrigable land be not available in the locality. The rent of six acres of land then at, say, ten rupees an acre, or sixty rupees in all, would be an annual charge against the class; which is moderate. There would be some initial outlay which, after consulting Mr. Robertson, I find would be wise: one iron plough Rs. 25, one pair of bullocks Rs. 80 to 100, one cart Rs. 80, implements and tools Rs. 50, but for one field labourer, and shed for a pair of bullocks, say Rs. 50; fencing Rs. 20—in all Rs. 325, to which add Rs. 100 for seeds, manure, and miscellaneous—total 425. The up-keep of the bullocks and the wages of the labourer would together amount to Rs. 30 per mensem, or Rs. 360 per annum. There would be annually recurring contingencies, but these would be defrayed from the produce of the six acres.

14. It would not be practicable at present in these school classes to afford out door veterinary instruction—though the principles of it would be taught in the class-book.

15. The annual charges then of a High School agricultural class would be thus:—

Teacher (at Rs. 60 per month.)	Rs.	720
Rent of six acres	„	60
Wages of one labourer and up-keep of one pair of bullocks	„	360
	Rs. ...	1,140.

The initial outlay would be Rs. 425. These figures have been carefully verified by Mr. Robertson. For six such schools the annual outlay would be Rs. 6,840, and the initial outlay would be Rs. 2,550. These expenses seem moderate. If the whole of them cannot in these times of financial pressure be afforded, still a portion of them certainly can be afforded; that is, if six classes cannot be afforded, we may begin with four classes, and so on.

16. The annual expenses of an agricultural class at the Poona College is, as already seen, set down at Rs. 6,000. Thus the annual cost would be for—

Schools	Rs.	6,840
College	„	6,000
	Rs. ...	12,840

and the initial outlay Rs. 2,550, say with extras Rs. 3,000. With these moderate sums a humble but sound system of agricultural education might be set on foot in this Presidency. A beginning might be thus made. If it should succeed, then the outlay might be augmented hereafter according as the demand might grow or as our financial means might increase.

17. If my honourable colleagues shall approve, the Director of Public Instruction might be requested to arrange to open the six high school classes from the commencement of the next official year, that is, in April 1879. It should be explained, however, that the teachers from the Sydapet institution cannot join till June, as they will not have completed their course and obtained their certificates until that time. However, it will suffice for them to join by the 1st or even the 15th June, when the agricultural year begins.

18. The foregoing remarks apply to what may be termed superior instruction in agriculture in the upper schools in English. Our object should further be to scatter broadcast as it were the elements of such instruction among the middle schools in the vernacular. Now, although six acres represent the minimum area on which superior instruction can be afforded, Mr. Robertson thinks that some elementary instruction, which would be much better than nothing, could be afforded to a vernacular class even on one acre. If there were difficulty in exhibiting ploughing, still the rotation of crops, some of the methods of culture, and the use of artificial manure, could be exhibited even on this small space. One teacher, trained in the superior classes above described, might in some localities serve several schools, say three; then if his salary were, as before, Rs. 60, the charge to each school would be Rs. 20, or Rs. 240 per annum, to which would be added Rs. 10 for rent of one acre and some small initial outlay, say from Rs. 100 to Rs. 200. It is impossible to estimate exactly the cost, but it manifestly will be but small; and if these classes became at all popular, the village headmen and other peasant proprietors will be sure to render help in defraying the charges. If teachers shall be obtainable, such classes would soon multiply and men will be qualified (natives of this Presidency) at the Sydapet institution by the middle of next year. In after years they will become qualified in our own superior classes. As regards the curriculum the agricultural class-book in English alluded to will be soon translated into the vernacular; or rather a vernacular class-book of a similar scope will be prepared.

19. Besides the agricultural instruction given, together with experiments on the ground, some rudimentary instruction can be given in all primary schools by means of a primer of agriculture in the vernacular. Mr. Robertson will, as I learn, be good enough to assist in preparing such a primer suited to the circumstances of this country, and then we can soon have it translated into the vernacular. When the teaching of the primer shall be established in the primary schools, some arrangements might be made for having itinerant instructors going about and lecturing from school to school, showing some simple experiments, illustrating the things taught in the primer and so on. Arrangements of this sort has, I believe, been adopted with success in some countries.

20. One effected method of diffusing a knowledge of agriculture among the land-holding classes is to ensure that our native Revenue officers and officials shall graduate in this science, the Mamlatdars, the Mahalkharis, and those Karkuns who hope for promotion to the higher grades. We are already endeavouring to arrange that all these officials shall be graduates of the University. If a degree in agriculture shall be established by the University, then a preference might be given to that degree over other degrees for this particular class of appointments. Or else it might be ordered that all officers and officials in the land revenue department must go through an agricultural course, the higher grades through the college course, the other grades through the school course, as above described. Further, as the system takes root, it will not be difficult to arrange that all headmen (Patils) and village accountants (Kulkarnis), whose hereditary appointments require the confirmation of the authorities, shall pass some elementary examination in agriculture.

21. My honorable colleagues will doubtless agree with me in acknowledging our obligations to Mr. Robertson for the interesting information and valuable advice which he has afforded us, and to the Madras Government for so kindly lending us his services for a short time.

RICHARD TEMPLE.

Minute by the Honorable Mr. Gibbs on Agricultural Education, dated 1st November 1878.

I entirely concur in the exhaustive Minute of His Excellency the President, and shall be very glad to find that funds can be provided to carry out all his suggestions.

It is quite time we instituted schools for this purpose. In Guzerat the want has been so much felt by the enterprizing land-holders in Kaira that they have availed themselves of the institution at Sydapet in Madras; and from what was said at the Conference held at Gunish Khind about two months ago it would appear that a desire very generally exists to improve the cultivation by rotation of crops, manuring, and other plans which can only be communicated by those trained in Europe; and although experience has taught the natives of this country to utilize many of the resources which nature has provided for them, still the spread of agricultural science will doubtless lead them to make greater use of those resources, as well as to find out others which, although now existing, are unknown to them.

The measure is one which seems to me likely to increase the wealth of the people in a most substantial way; and though doubtless any very great strides in this direction are not to be expected at once, still we must remember that every student who leaves such a school may be looked on as a pioneer to instruct his fellow villagers and so render his own knowledge ten-fold more valuable to the common weal.

Our thanks, as suggested by His Excellency, are due to His Grace the Governor in Council, Madras, for so kindly placing Mr. Robertson's service temporarily at our disposal; and I venture to think that not only to him for the information he has given, but also to Dr. Cook, the Principal of the Civil Engineering College, for the ready response he has given to His Excellency's wishes, our thanks are due.

J. GIBBS.

Minute by the Honourable Mr. Ashburner, dated 3rd November 1878.

I appove of the scheme for the establishment of an Agricultural and Veterinary Class attached to the Poona Engineering College.

L. R. ASHBURNER.

RESOLUTION.—In reference to the foregoing Minutes in Council the Governor in Council decides that a College class for instruction in Agriculture should be attached to the Civil Engineering College, Poona, and declared open for students who have passed the University Matriculation Examination.

Three years should be fixed for the present as the period for the course of study. The Finance Department will be asked to sanction scholarships tenable for one year, according to the list given in the next para, to be competed for (1) by the students entering the class, and (2) by those who have completed their first year. As care is necessary to prevent students joining the class for the sake merely of the scholarships, and with no serious intention of making any practical use of agricultural knowledge, the scholarships should not, as a rule, be awarded at a greater proportion than one to every candidate in the class, and the Principal of the College should have the power at his discretion to withhold them altogether should he consider the candidates undeserving of them. At the same time, within the maximum number below stated, the Principal should be given discretionary power to increase the proportion of scholarships to the strength of the class, in the case of deserving candidates whose poverty is undeniable, or who belong to the agricultural classes.

It is possible that hereafter it may be proper to reduce the ordinary proportion of one scholarship to two students, but it is important to offer to students a fair inducement to start the class.

2. The scale of scholarships proposed as a maximum is as follows—

		Per mensem. Rs.
To be competed for at Entrance Examination.	2 at Rs. 10 each	20
	2 at „ 8 „	16
	4 at „ 7 „	28
	1 at „ 6	6
	1 at „ 5	5
		75
	1 at Rs. 12	12
	3 at „ 10 each	30
	1 at „ 9	9
	4 at „ 8 each	32
		83
	Total per mensem ... Rs.	158
	Per annum ... Rs.	1,896

3. The scholarships according to this scale, even if all awarded, will cause an expenditure less than that proposed by the Committee by Rs. 744 per annum; and the Governor in Council being of opinion that it is of great importance to add a course of Veterinary Lectures to the instruction to be given in the class, would allot Rs 660 for this purpose—Rs. 300 being assigned for 25 lectures to students of the first year, and Rs. 360 to 30 lectures to students in the second year.

4. In respect to the establishment of agricultural English classes at six of the High Schools in the Presidency, the Director of Public Instruction is requested to take steps in accordance with the principles laid down in the Minute by His Excellency the Governor and to submit proposals in detail after local enquiry. The several Commissioners and Collectors are requested to aid the Director in this important matter to the utmost of their ability.

5. A similar instruction is applicable respecting the establishment of Vernacular Classes according to the principles laid down in the Minute.

By order of His Excellency the Honourable the Governor in Council.

C. GONNE,

Secretary to Government.

BONES AND SUPERPHOSPHATES.

PLEASE answer the following queries:

1.—What chemical changes take place when 100 pounds of raw ground bone are dissolved with sulphuric acid? Is sulphate of lime (gypsum) formed, and what proportion?

2.—Is bone made more available for plant food by the use of acid, and if so, why is it ever used undissolved?

3.—What is the difference between, and relative value of dissolved bone and dissolved South Carolina rock?

4.—Is it advisable to mix gypsum with superphosphate before using, or is there a sufficient quantity already present?

5.—Is it proper to mix wood-ashes with hen-manure, and if not, what are the chemical changes that make it improper?

6.—Is the strength of the odour from a superphosphate a good test of its agricultural value?

7.—In an analysis like the following, where only from 13½ to 18½ per cent. of available chemicals is given, what is the probable value of the balance of the 100 parts for agricultural purposes?

Available phosphoric acid	8 to 12 per cent.
Ammonia (potential)	2 to 2½ ,,
Potash (K.O.)	3½ to 4 ,,

You will oblige me and probably many others, by giving full and practical answers to the above.

C. L. L.,
Berryville Va.

[*Answer by* Prof. S. W. Johnson, *Sheffield, Scientific School.*]

1.—Raw ground bone is somewhat variable in composition, but contains about as follows:—

	Per cent.
Water	10
Organic matter, gelatine and fat	30
Sand and impurities	4
Phosphates of lime and magnesia	50
Carbonate of lime	6
With nitrogen	3
With phosphoric acid	24

When finely ground raw bones are treated with somewhat diluted sulphuric acid, they are not dissolved, in the strict sense, but they are disintegrated, and their phospates are so changed chemically as to be dissolved upon adding a large quantity of sulphuric acid that is used. For agricultural purposes, the point is to render a good share of the phosphoric acid soluble in water as cheaply as possible. To accomplish this, the bones must be mixed with diluted sulphuric acid, enough to take away from the bone-earth (tricalcic phosphate) two-thirds of its lime, making therewith sulphate of lime (gypsum), and leaving superphosphate of lime (monocalcic phosphate). Before the sulphuric acid will touch phosphate it must decompose the carbonate present, converting its lime into sulphate. Six pounds of carbonate of lime require, in round numbers, 6 pounds of oil of vitriol for this purpose, and the product will be 8 pounds of gypsum. To convert the 50 pounds of phosphates into superphosphates will require 26 pounds of oil of vitriol, and the result of this conversion will be 40 pounds of monocalcic phosphates and 48½ pounds of gypsum. The 55 pounds of phosphates and carbonates will thus yield, with 26 pounds of oil of vitriol, 56½ pounds of gypsum and 40 pounds of monocalcic phosphate. The excess of the latter 96½ pounds over the former 82 pounds is due to 18½ pounds of water, which the gypsum and the monocalcic phosphate take into chemical combination, and which is provided for by diluting the sulphuric acid with twice its bulk of water before mixing with the bone. The above result is never quite reached, because, owing to the coarseness of the bone and the bulk of the gypsum formed perfect admixture and contact between the phosphates and the sulphuric acid is not attainable. More sulphuric acid will effect complete solution of the phosphoric acid, but in practice that is not advisable.

2.—Bone is certainly made more available as plant food because it is made more soluble, and thus admits of immediate distribution to the soil. The effect is not to make the phosphoric acid any better for the plant, but to make a given quantity of it to feed more plants in less time than would happen with bones not sulphated. The nitrogen of the bones is also rendered more rapidly accessible to plants by this treatment. The ultimate effect of acting on bones with sulphuric acid is the same as that of extreme pulverization. Bone flour is as actual and effectual a fertilizer as the sulphated bone. The reason why bones are ever used undissolved is simply because under many circumstances it costs less to do so. In other words, a given amount of money and labour expended in raw bone often goes further and does better than when put into sulphated bones.

3.—The difference is, that dissolved bones contain 2 to 4 per cent. of nitrogen of which South Carolina rock is destitute. The relative money value depends of course upon how they are made, or what quantities of nitrogen and soluble phosphoric acid they contain. Nitrogen in sulphated bone is worth 20 cents. per pound in our commercial centres, while soluble phosphoric acid is worth about 12½ cents. The relative fertilizing value depends upon the soil and crops they are applied to. When nitrogen alone is needed to make a crop, the South Carolina rock would, of course, have no fertilizing value.

4.—There is no occasion to add gypsum, unless more is wanted than the usually small dose of dissolved bone would supply.

5.—The white portions of bird dung consist of *urate ammonia.* If mixed with quick lime, ammonia, will be copiously set free, and go off as gas, urate of lime remaning; but if the mixture be mixed and covered with abundance of moist loam, the ammonia will be retained in the latter.

6—.No; none whatever. The richest superphosphates may be quite free from strong odour.

7.—Eight to twelve per cent. of available phosphoric acid usually implies 40 to 23 per cent. of gypsum; 2 to 2½ of potential ammonia implies 30 to 40 of animal matter, and 3½, to 4 of "potash" implies 8 to 12 of sulphate or muriate of potash. Then 20 per cent. of moisture, and 1 to 5 of sand or soil, are practically inseparable from most commercial fertilizers.—*Montreal Herald.*

CULTIVATION OF CAROLINA PADDY.

In the latest published report on the working of the Sydapet Farm, Mr. Robertson devotes a whole chapter to the subject of Carolina paddy and the experiments made in the presidency to introduce it. Since the past ten years, the Government have done much to encourage the growth of the paddy, and with that view imported supplies of the best or "gold seed" from America. About four hundred bushels of the Carolina paddy seed were sent to Madras and distributed gratuitously over all parts of the presidency. From the reports submitted by the Tehsildars and Collectors of the districts under whose observations, experiments were carried on, it appears that in some cases good crops were obtained. The opinion advanced that the climate of Madras is unsuited to the cultivation of Carolina paddy, is considered untenable. Mr. Robertson holds that by the Indian cultivator adopting an intelligent system he may "secure to the plant those good agricultural conditions which in America is invariably met with." In the experiments carried out in this presidency, the land was not properly manured except by the silt deposited by irrigation water, some plots were puddled and worked according to the native system which is highly objectionable. It obstructs the passage of the irrigation water through the soil. The system adopted of preparing nursery beds was also objectionable, and hence a "difficulty was experienced in pulling up the Carolina paddy plants for transplanting." The irrigation of the crop was conducted in the ryot's own fashion. No care was taken of the plants during growth besides a little weeding: the practice of hoeing is almost unknown to the cultivators—the entire absence of tillage operations is one reason, why the results in certain cases were unsatisfactory. The ears of the paddy were one-third to one-half heavier than those grown in the country under similar conditions—the average number of grains in an ear varied from 150 to 200, while many plants had from 10 to 12 fertile ears. The ryots complained that there was difficulty in separating the grain in threshing. More labor has to be expended in threshing Carolina, than country paddy; but the system adopted in this country is such as to produce a great deal of waste. No benefit is likely to result unless labor and pains are bestowed on any undertaking. In the threshing of Carolina paddy, it is necessary to spend some labor, especially as the results are most encouraging, and the yeild largely in excess of the country produce. All the experimentors were agreed upon the fine size of the grain; they were agreed as to the yield being larger than country paddy, and they found that the straw produced was stronger than any of the indigenous varieties, and valuable as fodder for cattle: other ryots however reported that their cattle refused to eat the straw as it was coarse. The fact was lost sight of that the Carolina paddy plant was able to withstand rough weather better than the country paddy, "storms that would prostrate crops of country paddy, would pass over crops of Carolina paddy harmlessly." A tabulated return was prepared of the yield of the paddy: in some cases it, was very much larger than any description grown in the country and in others, it was higher than the average yield in South Carolina. Supplies grown in Madras and in the Sydapet farm, were forwarded to England to be sold in the market there as an experiment. The price realised was not high, but the Brokers reported that if it is to be successfully introduced into the London market, it must be of better quality and be properly cleaned. The conclusions drawn by Mr. Robertson from the reports of experiments carried out are, that Carolina paddy can be grown successfully in the Madras presidency with care and proper management; past experiments were unwillingly undertaken, and consequently many unsatisfactory results were obtained. That the yield varies according to the care bestowed on a crop is amply borne out by the fact that, in one district, the yield on a certain field was 30-fold and in an adjoining district 120-fold. There are of course

difficulties in the way in growing a new description of grain in the country—that difficulty says Mr. Robertson was felt when the rice crop failed in Italy in 1829, and when seed paddy was introduced there from Carolina. The paddy which grows so luxuriantly in South Carolina, was introduced there from Madagascar, and it is suggested that instead of sending to America for seed for further experiments, supplies should be had from Madagascar. In any case, a great deal will depend upon the manner in which the grain is prepared for the market, as the high price obtained for the Carolina rice in London, is attributed to the way in which it is prepared and sold. It was intended to publish Mr. Robertson's report on paddy cultivation in the shape of a Manual or Guide, for distribution in different parts of the presidency, especially in those districts where experiments were properly made. But that intention has not been carried out as yet : a concise Tamil translation of this interesting paper will be very useful in disseminating among the ryot classes valuable information as to cultivating Carolina paddy.

MISCELLANEOUS NOTES.

THE PLANTING OF EVER-GREENS.

THESE may be planted at all seasons of the year with equal success. One of the principal things to attend to is to fix on a dull day for winter planting, and on a moist day for spring and autumn planting. Prevent their roots from becoming dry when out of the earth. Poor land, strange to say, which has been trenched and ploughed and proved unable to yield a crop of grain, if planted with ever-greens for a few years, becomes fit for agriculture.

NIGHT-SOIL AS MANURE.

THIS as most planters are aware, is a very powerful manure, liable to decompose, and abounds in carbon, hydrogen, azote, and oxygen, and in whatever state it is used supplies abundant food to plants. Of course the smell is disagreeable, but this can be cured with quicklime. Many people do not know, however, that if sprinkled with quicklime in fine weather it dries and is easily pulverised. The Chinese have much practical knowledge of manures, and they mix one-third of fat with it, make it into cakes and dry it in the sun. In this state, it is pulverized and delivered in the furrow with the seed. This is in effect desiccated night-soil, and is sold in French commerce as *poudrette*. This valuable manure is distributed over the hop-grounds of Kent. For stimulating tea plants the Chinese use it generally mixed with "ox-horn" grindings, to prevent the too rapid decomposition of the animal matter.

CHICORY AS A SALAD.

ONE of the easiest grown salad compounds in India is chicory and in the opinion of Dutchmen in Sumatra and in Java it is superior to lettuce. Garden cress is also easily grown, but one seldom can get a gardener to attend to it. At a time when eight annas is asked for a moderate sized cabbage in the Madras market, we think it is about time, that, Europeans got something out of their compounds, other than the by no means succulent grass and weeds usually luxuriating in them.

ANALYSIS OF THE TOBACCO STALK.

PROFESSOR DAVY of Dublin, went into this matter, and found that the presence of the tannin principle could not be detected and the alkali afforded was not very considerable. One thousand parts of the stalk yielded fifty-eight of ashes, which afforded three parts and a quarter of alkali, mostly potash. The stalks contain nearly one-tenth of this weight of tobacco : and where tobacco is employed either in fumigating or in making decoctions for the destruction of insects, ten parts of the stalks will produce effects equal to one part of the leaves.

AGRICULTURE IN EGYPT.

THE state of agriculture in Egypt may be compressed into a "birds-eye-view" by any traveller versed in the slightest degree in agriculture. Rice is sown from March to May, and is, 6 months in coming to maturity. The plants are spread in thick layers (as no flails are used) on floors of earth and pigeon's dung, and are well beaten. When the rise of the Nile causes a great *expansion* of the waters the *profit* of the proprietors increases 50 per cent., as the land produces 80 bushels to one. There is no saying how an "expansion" of irrigation might enrich India.

CONCERNING IRRIGATION.

THE art of irrigation consists in floating *not* in soaking or drowning, as most people appear to think in India. A constant discharge or succession of water such as would be produced by a downpour of rain is as good an example of irrigation as we can give, but this is not sufficient ; neither will it do to dam up water and make a field like a pond, such as we often see in India. Wherever the natives of India in the matter of water are taught the difference between wilful waste and woeful want, the better. It must be borne in mind, that well irrigated fields should enjoy the element of air as well as water. To get this, water must be passed over the land with a brisk current. To see a lot of buffaloes wallowing up to their knees and ribs in a so-called stagnant irrigated field is one of those peculiar features in Indian native farming economy, which would strike a Chinaman as tantamount to insanity.

No wonder that in India the income of the native peasantry averages only £2 per year. According to a recent Government report, they admit themselves, that, the most an ordinary ryot makes is 16s. per month. It is all very well to cling to the notion, as most ryots do, like the Persians, that, the earth is motionless and the sun, moon, and stars revolve round it. But for Indian Government officials to go on collecting—collecting—collecting from people so grossly ignorant of agriculture as the Indian ryots, without improving their condition, is to emulate Turkish rule. The Holy Land, once the richest country in the world, is now the worst cultivated and pays only a quarter of a million sterling. Viewing the state of agriculture in India, we fail to see how the average Indian official can be supposed to be in possession by experience of knowledge to enable him to teach the Turkish peasant how to improve his condition.

C. W.

Madras.

AGRICULTURE IN NORTH BEHAR.

(Concluded from the Agriculturist or December.)

MR. REID gives the following account of steps that have been taken from time to time to improve the agriculture at Behar A few seers of American cotton, Carolina paddy, and maize seeds he states, were circulated some years ago by Government amongst the planters ; and a ram, supposed to have some English blood in his veins, found his way to Hutwah when the estate was under the management of the Court of Wards. Here and there some teak trees, and near Mozufferpore the tallow tree, may be seen by the road side ; and at Poosah is to be found the tobacco farm. This is all that has been done by the Government to improve agriculture and arboriculture in North Behar. The indigo planters have introduced English ploughs, steam cultivators, thrashing machines, Thomson's sugar mills, and portable engines with improved pumping machinery into the province.

Many years ago the sugar industry was started by Europeans in this province on a large scale, and most expensive machinery was imported ; superior kinds of cane too were introduced, but the whole business collapsed in a few years, and ruined those who had embarked in it. So far indigo is the only agricultural industry which has benefited the European settler.

I find that sub-soil ploughing has a most remarkable effect on the few crops I have grown in fields so treated. To show my ryots what can be done by deep cultivation and green manuring, I sowed three beegahs of light sandy land with common country maize, having previously manured it with 16 tons of refuse indigo plant per acre, and sub-soiled it. Fortunately for me there is a shepherd's field adjoining mine, and he folded his sheep thereon for three months before sowing it with maize. The two fields were sown on the same day, the 26th of June, at the same time with several other fields belonging to native cultivators, which had not been manured. It did not take long for the manured fields to pick themselves out from the ruck, and the crops in them are rearing their heads several feet above their neighbours. But my field is conspicuous above the shepherd's for the more healthy appearance of the crop *and the deeper shade of its foliage.* I shall invite the attention of the Collector of the District to this field to show what can be done by improved culture, even with native seed. In 1876 I produced from a plot of land an average of 36 maunds 6 seers of grain per beegah of 32,400 square feet ; the produce consisted of 16 maunds 13 seers of wheat per beegah from the *rubbee*, and 19 maunds 33 seers per beegah of Indian corn from the *khureef*. The plot of ground selected was an old indigo field. It is not unusual for a planter in these districts to get 2,100lbs. of wheat per acre from his land, and it must be remembered that he only sows a few acres for home consumption, generally selecting the poorest soil that requires a rest and change from indigo. And yet we know that 1,100lbs. is a very good average for the ryot to get in a favourable season from his *khureef* and *rubbee* crops put together. I shall now endeavour to place plainly before you the reasons why the soil has

deteriorated under the native system of cultivation. To begin with, the assemblage of the peasants in large villages is one of the greatest bars to improved agriculture. In olden times when the country was infested with tigers and dacoits it was absolutely necessary that ryots should club together in villages for mutual protection. But now that life and property are secure, any steps that are taken towards making the cultivators live more in the fields with their cattle, instead of tethering them up in villages, will confer a lasting benefit on the agriculture of the country. At present the dung and ashes are collected in exposed heaps opposite the huts, or very often near cess-pools, rivers, and ditches, and as the surface drainage of the villages always leads into the cess-pools from which the earth was taken for the walls of the houses, every shower of rain sweeps the essence of the manure into these hollows and watercourses. Besides, by tethering the cattle and other farm animals in the villages, their urine is completely lost to the fields and goes towards making the saltpetre for which poor wretched Behar is famous. Dr. J. Forbes Watson, in a report prepared for the Philadelphia Exhibition of 1876, mentions saltpetre as "another characteristic Indian produce." He might have added that it is characteristic only of wasteful extravagance, and the most slovenly system of farming practised in the world. The saltpetre of Behar is made from the surface earth of the village sites, which are impregnated with decayed organic matter. In North Behar there are 15,947 saltpetre works and 1,304 refineries, which produce annually 500,000 cwts. of material for exportation. Besides this amount of saltpetre about 100,000 cwts. of a saline composition named *khari* is also produced yearly in these districts. It is made from the earth known as *reh*, which effloresces in exhausted lands deficient in organic matter, and this is how it is prepared for market. Straw is placed on the ground and covered with saline earth to the thickness of about four inches. The straw is then burned, and the burned matter is again covered with a foot of straw, which is also burned: this process being repeated seven times, after which the heap is covered with vegetable matter for the last time and burned. The saline matter is then dissolved in water and boiled, and by this process *khari* is produced. The waste of straw and leaves in preparing the saltpetre and *khari* is enormous, and at a very low average. I estimate that 91,400 tons are used as fuel in this business, the ashes of which never find their way back to the fields......... ...

At least twelve per cent. of the cultivated lands of North Behar are annually sown with most exhausting crops, which cannot thrive without heavy manuring. And these crops, besides taking up the best lands and nearly all the available manure of the country, are in themselves *non-manure producers*. Therefore, as a natural consequence, they thrive at the expense of the cereal crops. I now give a list of the principal non-manure producing crops, with a memorandum showing the approximate area taken up by them :—

		Acres.
1	Poppy	173,133
2	Flax, Mustard, and Safflower	400,873
3	Sugarcane	44,000
4	Cotton	52,000
5	Sunn, Hemp and Putua	13,986
6	Tobacco	41,116
	Total ...	725,108

The high rates of interest charged for petty advances to cultivators prove another drawback to improved agriculture. The usual rates are 37½ per cent. for money transactions and 50 per cent. when the transactions are in grain. I have known 100 per cent. to be exacted for grain transactions. I do not believe that there is one ryot in a thousand free from debt.

Insecurity of tenure, and the want of a proper system in keeping village rent accounts, are also great drawbacks to an improved system. The proprietors are, as a rule, most unscrupulous and grasping; and the more wealthy amongst them leave their affairs to be managed by native underlings, who are a shade worse than themselves.

There is great popular belief in the deterioration of the soil and diminished crops. The ryots, when questioned on the subject, will answer: "In former years we used to get heavy and seasonable rains, and the crops were sown and gathered without any extraordinary labour. The fields used to be full of weeds, and when the rains commenced we simply had to plough twice and plant out the paddy, and we reaped heavy crops. But *now* we plough eight times, we carefully remove all the weeds, and even with all this hard work the crops refuse to grow as they used to." The natives also say that in days gone by the mango trees bore fruit regularly every year, but now they bear only every second year. This may be only a popular tradition. But still I would not be surprised if it was the case, as certainly the mango groves receive most atrocious treatment at the hands of the native cultivators; and it is surprising to me that they bear any fruit at all. To my certain knowledge the soil has deteriorated, and the crops are worse than they were when I first came to the district. Large tracts of land that used to bear crops of rice twelve or fourteen years ago are now given up to that pernicious *kodo* millet; and no better proof than this is wanted of the deteriorated state of the soil. Besides, a glance at the prices now ruling for the different kinds of grain will prove that the land does not produce so much as it used to. Bumper harvests mean low prices in these parts.

I have many suggestions to make for the improvement of the soil and of the condition of the people. These suggestions are certainly not disinterested, as they hinge on increased support to be given to planters and other non-official Europeans, as I am certain that without their guidance and assistance the natives will never better themselves or their country. The loss and waste by the present primitive system of agriculture are incalculable, and yet the Indian ryot takes upon himself to grow crops, with his limited means and scanty supply of manure, which a European agriculturist would not think of cultivating unless he had money and manure to assist him. The result of the ryot's abortive effort is, as I have already pointed out, the rearing of these exhaustive non-manure producing crops at the expense of the cereal crops of the country. I style the ryot's system of cultivating these crops abortive, advisedly, as the average produce is only one-quarter of what is produced in other countries where intelligent management is brought to bear upon the cultivation of such crops, as sugarcane, cotton, flax and mustard. And, when we take into consideration the millions of acres that are devoted to these crops throughout the length and breadth of British India, my suggestion to check this sinful waste of good land should not be treated merely as the Utopian dream of an interested adventurer. There is no reason why the sugar and cotton crops should not produce as largely in India as in other countries, and yet we find the average produce of sugar in India is 12 cwts. per acre against 50 cwts. in other countries, of cotton in India 50 lbs. per acre against 200 lbs. in other countries. And this state of things will go on until the end of the chapter if the Government does not interfere. The question will naturally arise: Why don't Europeans turn sugar and cotton planters in India if the produce can be increased so largely? The answers to this question are several: *1st*, the European has an impoverished soil to deal with in the first instance; *2ndly*, the Indian species of sugarcane have so deteriorated that the European would be a ruined man before, he improved them; *3rdly*, the cost of the plant and machinery of sugar works is so excessive that the European planter in India could not afford to work at a loss until he had improved the quality of the cane and increased the fertility of the soil. *4thly*, the sugar industry has not received the same fostering care from the Indian Government that has been bestowed on it by the Governments of their countries. *5thly* the cheap gúr and sugar of native production would drive the Englishman's sugar out of the local markets, as he cannot produce so cheaply as the native cultivator; and if he went in for making the same inferior articles, the markets would soon be glutted.

The same arguments apply in a great measure to the cultivation of cotton. Besides, the native ryot has very hazy ideas of the difference between *meum et tuum*, and the planter would find his fields robbed of half their cane or cotton if strict protective measures were not ensured him by the Government. The thieving propensities of the natives are the great drawbacks to Europeans engaging in a general system of farming in India. Indigo has escaped them in a great measure, as they cannot eat it, and they cannot manufacture it without fear of detection. However, these questions arise—first, should the indiscriminate cultivation of these crops be allowed; secondly, should not Government interfere and insist on the weeding out of all lands that produce less than 25 cwt. of sugar and 100lbs. of cotton per acre. To accomplish these objects licenses must be granted for the cultivation of these crops, and in these licenses it should be particularly specified that the straw and dung and ashes produced from the cereal crops *must not* be used as manures for these special crops. The lands reserved for the non-food-grain, non-manure-producing crops should be made to produce all the manure required, which either may be dug in or eaten on the land before sowing; or else extraneous matter such as *marl*, artificial, and mineral manures should be used. If these suggestions were acted on and improved upon, half the area of cultivated land that is now occupied with sugarcane and cotton, would suffice to produce the same quantity that is now made all over India.

Flax, mustard, safflower, castor and other oleaginous seed plants take up a vast area of the best cultivated land, not only in North Behar, but all over India. A superficial observer does not notice these crops so much, as they are generally mixed with the cereal crops of wheat and barley; but still the immense local consumption and enormous exportation from the country will prove that these crops are cultivated in a slip-shod manner to an alarming extent. Under the present system of cultivation these crops are a curse to the land, and yet no other crops could be made more beneficial to the agriculture of the country. The stocks of these plants are used as fuel; the seeds reserved for Home consumption

are sent to the village oilman, and the surplus stock is sold for exportation. The ryot gets back his share of oil, which contains no mineral matter, but the valuable manurial oil cakes are reserved by the oilman as his perquisite. If the ryot wants oilcake for his cattle he has to buy it back again, but as he is generally too poor to do that, he has to go without it. The oil cake is therefore sold to those who have set up trading carts. The trade in these districts is most active by bullock cart traffic. The roads are nearly all unmetalled, but they are well bridged and in good working order. Forming a low estimate of the number of carts in North Behar, I should say that there are fully 60,000, the bullocks of which are never tethered in the fields, but on the roads and in houses, consequently all the oilcakes these cattle consume is lost to the soil, except the very small quantity of ash which is saved from the cakes of burned cowdung. Under these circumstances it must be apparent to every one that the oleaginous seed crops are now a burden to the soil, and yet, what a blessing they could be made. Take flax, for instance, if it were sown separately for fibre as well as for oil, from well selected seed, a new industry would be started which would afford employment to thousands of the poor during the slackest season of the year. Moreover, there would be no waste of manurial substances by the process of preparing flax for market, as the flax water is a most valuable fertiliser, and the dry chaff when worked up along with fermenting farm yard dung will pass into a good mould. The fine fibre or thread of flax takes nothing out of the ground, as a bundle of well dressed flax will leave no ashes when burned. And again, if oil-mills were established throughout the country, and the exportation of oil seeds stopped, India would keep all its oilcake for the soil, and export oil which contains little or no mineral matter. This is a subject which deserves the most serious attention from the Famine Commission. The trade in oil seeds sprang up about the time of the Crimean War, in consequence of the closing of the Russian Ports, and has made most alarming strides of late. The total trade in grains and seeds increased in value from £3,850,000 in 1857 to £13,560,000 in 1877, or about 274 per cent., and it now constitutes 23 per cent. of the entire exports. I see nothing but ruin staring India in the face from the nature of its export trade. What does the poor starved soil get back for all the saltpetre, oil-seeds, cotton, sugar, opium, and tobacco robbed from it, and sent across the seas? For besides having to supply its own teeming population with these common necessaries, it also enters into a large export business of an exhaustive nature; moreover, it buys back its own cotton, in the shape of piece goods from England, to the tune of sixteen millions sterling per annum. One would fancy the cotton was sent backwards and forwards from India to England to be seasoned, or at any rate that the country was too thinly populated to admit of the cotton manufacturing industry being started on a large scale! No wonder that all this blood sucking has at last weakened the paitent, and laid him on his beam ends. And yet the only crop which is cultivated at all on rational principles, and which acts as a tonic to the impoverished soil, is made the subject of most bitter attack by the local Government and some of its officers. Sir Ashley Eden's persistent attack on indigo always reminds me of the fearful onslaught made by Mr. Winkle on the small boy. There are bigger and more worthy foes scattering the salt of India's soil to the winds of Heaven, and yet Sir Ashley expands himself in squaring up to a miserable 2,000,000 acres of indigo land. Indigo is the only crop which returns any vegetable matter to the soil in Behar. It is a leguminous plant, growing to the height of five and six feet in favorable soils. It is always cut green, two cuttings being obtained in the year. The refuse plant and indigo water act as most valuable fertilisers. Being a legume it absorbs a considerable amount of ammonia by the leaves, and a field in which indigo has been cultivated is enriched with nitrogen. Besides, all that this luxuriant growing green crop sends out of the country is 20lbs. of dye per acre!

At the very feet of the royt's fields lie the material to turn the country into a garden. For instance, in Chumparun there is a chain of shallow lakes covering an area of 139 square miles, with a layer several feet thick of rich fertilising marl. And again, there are the magnificent fodder crops of the East, such as the *Sorghum saccharatum, sorghum vulgare*, and others, which are the most luxuriant growing grasses in existence, capable of producing unlimited supplies of fodder and manure. But a long purse, low interest, and a guiding hand are required to develop these resources.

I cannot say that free trade principles have improved the condition of the royts. Being notoriously poor and improvident they have sold their grain in seasons of plenty, and starved in seasons of scarcity. The most extraordinary thing connected with the Indian grain trade is the rapidity with which prices fluctuate from cheap to famine rates. Barley may be selling to-day at one rupee per maund, and six months hence it is not procurable at half that rate. And we can rest assured that when the price of grain is verging on famine rates, the cultivators are not the men who profit. *They* are the great *consumers* in the country and, as at best they only produce enough to keep body and soul together, it is *their* object (if they could only act upon it) to keep their granaries *full* and prices *low*. At present the *mahajun* is the ruling spirit of the age, and he has grown fat at the expense of the Government reputation and the masses of the people. It is sinful the way these men are allowed to deal with the people, more particularly in grain transactions, and as much as 100 per cent. profit is as often as not made by the village grain dealers. The months of June, July, and August comprise the season during which the agriculturist is hardest pinched for food. He borrows freely during that period from his *mahajun*, and in September has to pay back 50 for every 40 seers of grain borrowed—very often 60 seers are exacted. An energetic *mahajun* who goes in for quick returns may double his capital within the year. Now, I have to propose that the Government put a stop to these usurious transactions once and for ever by opening its hand, and establishing grain stores throughout the country, which stores would eventually prove pillars of strength to the State. There is no occasion for Government to have a separate establishment for this business, which might be entrusted to trustworthy planters and zemindars. The transactions should all be done in grain; and the grain stored should only be the hardy millets of the country, which are never attacked by weevils, and which keep sound for years without spoiling.

The store-keepers should be bound down not to sell this grain, but to exchange it in kind at reasonable rates. For instance, a royt borrowing 40 seers of grain in June would return in September 42½ seers. And if this system of quick returns in kind at favourable rates is introduced, the stored grain will accumulate at such a rate that in a few years there will be enough to feed the whole population even in the worst of seasons.

The breads made from the *murova* and *cheena* millets are wholesome enough, though tough. No loss by wastage arises from storing these millets, even though they should be kept for thirty or forty years. I beg of the Famine Commission to think of the reputation gained by Joseph for his wise precautionary measures; and the Commission should not be above taking a hint from one who successfully combated against a seven year's famine in Egypt.

I have now to recommend the planting of more fruit trees, such as the jack, muhwa, and mango. During the present season of distress I have particularly noticed the important part played by these fruits in staving off famine from the ryots' doors.

There are many estates under the management of the Court of Wards in this province, but to my certain knowledge no experiments worth being recorded have been made in agriculture, and the improvements introduced have been more in the direction of adding to the numerous roads of the province, or building new palaces and bazars, and laying out pleasure grounds.

The irrigation canals of India are the offsprings of an impoverished soil deficient in organic matter. It was only when we found that our lands would neither attract or retain moisture that we commenced to shout for canals. If I were proprietor of Behar I would not have an irrigation canal in the place, although I would always keep the natural water-courses full of water. But as I am not proprietor of Behar, and have no means of stopping the great waste of cow-dung and vegetable matter which goes on in the province, I see seasons of drought and partial rainfall looming before us; and therefore on the principle that half a loaf is better than no bread, I have raised my voice with the best of them, and shouted for canals. Eighteen years ago, when I first came to the country, the planters would have scouted the idea of having canals in North Behar, but for the last four or five years they have been begging and praying for them. There is no stronger proof required than this deterioration of the soil; and I again repeat my well-worn dirge that deficient rainfall is caused by an exhausted surface soil. Irrigation is our *last* resource.

I have, this year, seen what I never saw before, and that is, numbers of large trees dried up by the roots for want of moisture; and I have no hesitation in saying that this would not have happened if the leaves had been allowed to rot on the ground, instead of being swept away as they fell.

It is not likely that any large area of the cultivated lands will ever become waste again, and neither is it desirable that this should happen, as the wild grasses of India are of a very bad quality; and even where the cattle are plentifully supplied with them they never seem to thrive, but are to the last degree wretched. These grasses were only valuable in promoting *humus* in the soil to act as an attractor and retainer of moisture. Now, that there are no longer large tracts of waste land, it is positively imperative that we should copy the laws of Nature and promote organic matter in the soil. When a piece of old waste land is broken up it is black with *humus*, but in a very few years after it has borne cereal crops, under the present spoliation system of Indian farming, it becomes almost as white in colour as the palm of my hand. In my opinion no laws can be too stringent which are framed with the object of stopping the enormous waste of vegetable matter. Even should the natives rebel against the new innovations I would fight it out with them, and make them adopt measures to restore the fertility of the soil. Is it a fact that we are afraid of the natives of India, and are obliged to pander to the wilful prejudices of an ignorant body of peasants, who have already succeeded in rendering arid the once fertile lands of Hindostan?

In neglecting the agriculture of this vast land we are proving false to our self-imposed task of governing India for India's sake; and we shall have to answer before God for this wilful neglect of our duties. Let us, however, rouse ourselves before it is too late, and endeavour to remedy the immense harm already accomplished. Remember that it is a glorious undertaking, more glorious in its object than all the British ends of justice, canals, and railways which have hitherto been crammed down the unfortunate native's throat, as it is the only real preventive of famine; and by taking Hindoo prejudices by the horns now, and wrestling with them successfully, we are conferring a lasting benefit on future generations. Really, from the way we have hitherto managed India, one would think that we farmed it for a certain term of years and were trying to make as much as possible out of the wretched land during the short period of our lease.

The natives must be made to set more value on the vegetable produce of their fields. From the little cow-boy, who burns bundles of grass to keep the flies away from his cattle, to the high caste orthodox Hindoo, who consigns the ashes of his relatives to their last resting place with the aid of cow-dung and mango wood, they must one and all be taught, *that it is the wholesale burning of the produce of the soil which has* brought these seasons of drought to the arid plains of India. The *arhar*, cotton stalks, and maize roots are more than enough to supply fuel to the inhabitants, with careful management, *without the aid of a single cake of cow-dung*; as, at a very low average, I estimate that 2,700,000 tons of *arhar*, cotton stalks and maize roots are produced yearly in these districts; whilst the consumption of fuel for a population of 7,889,381 souls should only be 2,535,864 tons per annum; this is at an average of 60 lbs. per month for each inhabitant, which is very high.

All the villages in the province should have distinguishing brands for their cattle, and all cattle and buffaloes should be marked. Respectable natives are at present obliged to tether their cattle in the villages, instead of folding them on the fields, for fear of cattle-lifting. A recognised system of branding cattle would do away with this evil.

I shall now draw this paper to a close, as I have done my best to expose what I consider to be the most prominent evils connected with agricultural India. I have expounded ideas which will of course be pronounced wild and Utopian by the average Indian official, but still

I have noticed that these gentlemen meet every suggestion made for the improvement of Indian agriculture with the same argument. The ideas of these obstructive gentlemen are well described by a writer in the *Agricultural Gazette of India*, as follows : "These men seem to imagine that India is exempt from the operations of the laws, to which the remainder of the earth is subjected, or that these laws affect India in some special or peculiar way; they appear to think that the principles, which should govern agricultural practice in India must be specially Indian." And, therefore, if I have offended the dignity, or roused the ire of any one of India's hereditary legislators, all I can do is to ask him to remember the following lines from an old English drama :—

Pray, Goody, please to moderate the rancour of your tongue,
Remember, when the judgment's weak, the prejudice is strong.

THE MANAGEMENT OF CLAY SOILS.

ACCORDING with my thirty years' experience, the true way to conquer these soils and make them profitable is by very high farming—that is, after the under-surface draining, to feed them abundantly with rich cake-fed manure made under cover, and thence at once carried to the land without any intermediate dung-heap; adding, for a great mangel crop some 3 cwts. of Peruvian guano and 1 cwt. of salt. For a full wheat crop after mangel, apply 2 cwts. of guano and 1 cwt. of salt, intermixed before sowing, and applied at seed-time. I once grew 7 qrs. of wheat after heavily manured mangel, and never expect less than 5 qrs. per acre. All this implies that we have plenty of cattle-making manure under cover both summer and winter, for which ample capital must be found. Our red clover is first mowed for hay, then immediately top-dressed with twelve cart-loads of fresh-made rich cake manure direct from the covered yard. When the second growth of clover comes well above this manure, fattening sheep are folded on it, consuming cake, corn, malt culms, &c. The land is then 'saucy' for white wheat, which must not exceed one bushel of seed per acre. After the white wheat is harvested, we take on the same ground a crop of rivetts, and then mangel heavily manured. In 1868, a good wheat year, I thus harvested 8 qrs. per acre of fine white wheat, sold from the machine at once at 63*s*, per qr. ; and on the same ground grew, in 1869, 7¼ qrs. of rivett wheat, followed by 39 tons of mangel. These heavy dressings and large crops are a certain cure for stiff clays, for they diminish greatly the *pro rata* fixed charges of rent, rates, tithes, seed, and manual and horse labour.

Poor farming and small returns on such soils are ruinous. It would be better not to farm at all than do so with insufficient capital. These non-calcareous, glutinous clays, which crack in drying, and are therefore unfit for the ordinary brick-making. They are like bird-lime when wet, and extremely hard when dry. Sheep cannot be folded on them in the wet season. Carting roots, off, and carting manure on, is no easy task at times. These clays soon run into a mud condition if water stagnates in them; therefore the most important conditions are under and surface drainage, to plough them before winter, taking especial care, even where under-drained, to keep open furrows and water furrows to withdraw water quickly from the seed-bed, and thus preserve as much as possible, its friability. I knew of some large farms in Essex on these clays, which caused heavy loss to farmers who came from a friable or drier district, and who have laid these lands on the flat, and have thus lost their crops in the mud. I know of such farms, even where under-drained and fairly manured, which have failed for want of open surface furrows, especially where deeply steam-ploughed. A farmer, used to a friable dry soil, workable at almost any time, feels perplexed and annoyed on our stiff clays, where horses or steam ploughs cannot go on the wet land for many days until a propitious change. A wet, frostless winter on such soils causes much idle time for men and horses.

Frost (when we can get it) is the grand and uncostly pulverizer of such soils. I once ploughed part of a field when wet for oats ; frost did not come, so the furrow slices dried as hard as cast iron, and were too obdurate even for my Crosskill, so as rain did not come in time we could not sow our oats until too late to get a crop. Strangers could hardly realize such a condition of soil, and should, therefore, consult local practice. Where steam ploughed in autumn on the flat, local farmers immediately draw out open furrows (at a distance of 7 feet in Essex) by the ordinary horse plough, to keep the land dry during winter, so that, for spring sowing it would only require broadsharing or scarifying. Spring ploughing for root crops in these dense soils is a very hazardous affair now. Farmers are finding out that very deep cultivation with the powerful steam plough is a costly mistake. Too much of the bad subsoil gets mixed with the seed-bed. Steam ploughs are now much used in this neighbourhood, but at diminished depths. These dense clays are unsuited for permanent pasture, but grow fine crops of red or white clover, winter tares, and especially mangel wurzel. The climate is too dry for swedes. Cabbages do well. Winter wheat and Tartar oats thrive, but the land is too stiff for barley. No rye-grass is sown with the clover, which is only taken for one year, and followed by winter wheat, which has an abundance of straw. The land for mangel should be very heavily manured with covered yard manure, ploughed under before winter, and only scarified in the spring receiving an addition of 3 cwts. of Peruvian guano and 1 cwt. of salt. Very heavy crops of mangel (30 to 40 tons per acre) may thus be grown on these soils, while swedes would generally be mildewed and a failure.

Covered and enclosed yards are the great panacea for such soils. In these cattle should be fed winter and summer as manure-makers on cut up green food or pulped roots, mixed with plenty of cake, corn &c. Horses should also have cut up and prepared food. Sheep do well in winter under cover, either on straw or sparred floors. They do not get foot-rot in covered yards, although they do so in uncovered yards. These stiff soils are impracticable for sheep in winter. I fatten them very successfully under cover, but they require less warmth than cattle. The great advantage of covered yards is economy of straw, preservation of manure, which should go direct to the field, 10 loads of it being equal to 15 of dung heap or open yard manure. Thus there is a great saving of horse and manual labour. My neighbours are at length availing of them. With proper ventilation, and a slight daily littering, animals in these yards are especially healthy. I have experienced this for fully 30 yards. By covered yards these heavy lands become meat-makers, which I consider most important. I make meat to get manure, and thus obtain maximum corn and other crops. Such arable farms require much tenant capital—£15 to £20 per acre would not be too much, to produce the most profitable results. It is a great mistake to take such farms with only £8 to £10 per acre. The amount invested in live stock alone should be at least £6 per acre ; much of it fed on imported food. It is surprising how far a good green or root crop will go if passed through the cutter or pulper. It pays better than turning out and roaming at large. Iron hurdles on wheels for sheep pay well. In conclusion both I and my bailiff are fully convinced that this farm could not be profitable at present prices with uncovered yards, the roaming at large of animals, and the undrained and little fields of ancient custom. I feel for those who still have to farm under such adverse conditions. The extra £1 of rent for all modern improvments is the key to profit.—*J. J. Mechi.*

THE GUTTA-PRODUCING PLANTS OF THE MALAY PENINSULA.

IN an appendix to a report of an expedition to Perak, recently made by Mr. Murton, the superintendent of the Botanical Gardens, Singapore, a good deal of information is given regarding the sources of the different kinds of gutta produced in the Malay Peninsula. Five varieties are enumerated, and their respective values in Perak and Salangor given as follows :

		Price per picul. In Perak.	In Salangor.
1.	Gutta-soosoo	... 50 to 52 dols.	not known.
2.	Gutta-taban	... 45 „ 50 „	50 dols.
3.	Gutta-rambong	... 32 „ 35 „	not known.
4.	Gutta-singgarip	... 17 „ 20 „	20 dols.
5.	Gutta-putih-sundek	... 15 „ 30 „	15 „

Of the first—gutta-soosoo—Mr. Murton was unable to obtain any samples of the tree producing it, and the only information he could gather concerning it was that the tree is entirely destroyed, except in the interior of Perak ; that the gutta is firmer in texture than gutta-taban, and contains a little oil. This must not be confounded with the gutta-soosoo of Borneo, which is a caoutchouc or rubber.

The second, or gutta-taban, is the gutta percha of commerce, and the product of a tree described so far back as 1837, by Sir William Hooker, under the name of *Isonandra gutta*, but now known to botanists as *Dichopsis gutta*, Bth. It appears that, in Perak, there are two sorts alike in foliage and general appearance, and differing only in the colour of the flowers, one being white and the other red. They are known to the Malays by the names of *Ngiato putih* and *Ngiato merah*, but the products of both trees are called gutta-taban. *Dichopsis gutta* is most abundant on Gunongs Meeru and Sayong, and Bujong, Malacca. A few large trees still exist on Gunong Babo and the Thaipeng range. Small plants, from one to eight feet, are abundant on the granite formations in Perak up to 3,500 feet elevation.

To procure the milk, the tree is cut down at five or six feet from the ground, and the top cut off immediately, when it becomes too small for ringing. This, the native say, causes the tree to yield a much larger quantity. The bark is then ringed with small knives called "golos" at intervals of from five to fifteen inches. The milk continues, to flow for about an hour, and is collected in vessels made of palm leaves or cocoanut shells, and then boiled for about an hour, otherwise it becomes brittle and useless. Regarding the quantity of gutta each tree is capable of producing, no trustworthy information seems to have been obtained. One of the principal merchants of Perak informed a member of the expedition that a large tree will yield forty catties of gutta, but Mr. Murton regards this as an exaggeration, for from numerous inquiries among the men in the jungles he was told that from five to fifteen catties is about the average quantity obtained, and never more than twenty catties. No particular season seems to be recognised in Perak for collecting the gutta, and Mr. Murton was unable to glean any information as to, whether or not the trees yield more in one season than in another. He considers, however, that in the wet season

the gutta contains more water, and consequently would require more boiling to drive it off. It is stated that from Klang 83 piculs, 88 catties were exported from January to November 1877; so that it is probable over 700 trees were destroyed to furnish that quantity. The gutta is generally, if not always, exported in the shape of oblong balls, with a loop at the upper end, through which a piece of rattan is put to facilitate its being carried through the jungles. These balls vary considerably in weight, from 10 to 20 catties is about the average. They are of a greyish-white colour, with a slightly reddish tint inside. The colour, however, varies according to the quantity of bark and other impurities mixed with it; sometimes it is of a bright umber brown.

For the cultivation of *Dichopsis gutta*, it is recommended that plants not more than a foot high should be procured from the jungles; it is necessary to lift them very carefully, as they have long tap roots which are liable to be broken or injured, in which case the plants, even if they survive, take a long time to recover.

The third kind of gutta, namely, gutta-rambong, is described as being more of the nature of caoutchouc, or india-rubber. Mr. Murton did not find the tree producing it and he was informed by the Malays that it was only to be met with in the interior of Perak, and on the Patane side of the Peninsula. These people describe the tree as having large roots above ground, and large, bright-green leaves, with red tips to the branches. The milk is obtained from these large roots, which are tapped ten or twelve times a year, a picul being sometimes taken from a large tree; the usual yield, however, is said to be about half a picul. This rubber is said to require no preparation for market. It has the appearance of long strings irregularly welded together; the best quality has a gum-like appearance, is very firm in texture, and of a reddish-brown colour; the inferior qualities have a large admixture of bark, &c. and are much drier, without the gum-like consistency of the better qualities. The caoutchouc from Perak has much the same appearance as Assam rubber, and Mr. Murton considers there is but little doubt that it is produced by the same tree *Ficus elastica*, description given by the Malays agreeing closely with that of the above-named plant, the red points to the branches being probably the conspicuous red stipules which envelope the young leaves. From the fact that young plants have been promised to the Singapore Gardens, it is to be hoped that ere long the origin of gutta-rambong will be definitely settled.

Another caoutchouc or India-rubber is gutta-singgarip. This agrees very closely in texture, appearance, and in the mode of operation with the gutta-soosoo of Borneo, and Mr. Murton says that an experienced authority, who had spent some time among the gutta-soosoo collectors in Borneo, assured him that they are one and the same product. The plant producing it is a large woody climber, with stems about six or eight inches in diameter, but often much less. There are two varieties; one with very dark coloured outer bark and lighter coloured warts, and red inner bark; and the other with outer bark light cork-coloured, with longitudinal channels, and the inner bark light yellow. The foliage of both plants are described as being very similar to each other, but the fruits differ in form, one being apple-shaped and the other pear-shaped. The fruits of both forms are edible, and are readily sought after by the Malays. The plants seem to be species of *Willoughbia*, belonging to the natural order, *Apocynaceæ*. The gutta from the dark-barked variety is considered the best. The long, scandent stems are often cut down to procure the milk, but it is not absolutely necessary to do so, except to render the operation of collecting the gutta easier. The stem is generally ringed at intervals of 10 to 12 inches, and the milk allowed to run into vessels made of palm or other leaves, cocoanut shells, or anything available for the purpose; it continues to flow for some time, but after flowing for ten minutes it gets very watery and thin. One plant will yield from five to ten catties of the coagulated caoutchouc. When raw it has the appearance of sour milk, and to coagulate it the natives add salt or salt water. When freshly coagulated it is quite white, but gradually changes to a darker colour. It retains its white colour inside, and upon cutting it is found to be porous, the pores or cells containing water and salt, which have become enclosed during coagulation. In texture it is soft, very spongy, and very wet. From January to November, 1877, 57 piculs 45 catties of this rubber were exported from Klang alone. Gutta-putih or gutta-sundek, is the produce of a species of *Dichopsis* the leaves of which differ from of *D. gutta* in being much shorter, broader and more ovate in general outline. The gutta is obtained and prepared in the same manner as gutta-taban and trees are frequently met with on the Sayong and Meeru ranges. Of this variety 484 piculs 56 catties were exported from Klang alone, from January to November, 1877. It is much whiter and more spongy than gutta-taban, and is worth only 15 dols. per picul as against 50 dols. for gutta-taban. In concluding this interesting report, Mr. Murton says:—"When crossing the Meeru range from Kinta to Kwalla Kangsa, I cut off some leafy branches from a tree which had been felled and ringed a few days before. These leaves were beautifully yellow on the lower surface caused by small peltate scales, and not pilose hairs, as in the *Isonandras* (*Dichopsis*), but on making inquiries from men about Sayong, they pronounced them to be foliage of some non-gutta yielding tree, which is certainly wrong, as I saw the dry gutta adhering to the bark where it had been ringed. A kind of gutta, called gutta-jalutong, is often used in Perak for mixing with guttas taban and putih, thus rendering them very brittle, but I have not seen the gutta, nor the tree producing it. *Isonandra Motleyana* is said to yield a gum which, in Java and Sumatra, is known as gutta-kollan, and is used only for adulterating purposes. Various species of fig (*Ficus*) yield large quantities of milk, which in Perak is known as gutta-barong, as the only use to which it is put is for bird-catching."

From the foregoing remarks, it will be seen that there is a great deal yet to be learnt about the sources of those valuable plants and trees yielding elastic gums, and it is to be hoped that, with an extended knowledge of the plants themselves, increased supplies may also find their way into commerce.

INDIAN SUGAR AT THE PARIS EXHIBITION.

ANALYSES made in the first fortnight of March on ripe cane Average samples of chips from the cutting of whole bundles, weighing from 100 to 120 lbs., taken for analysis.

	A good average bundle. 2 feet of Top.	A good average bundle. 2 feet Middle	A good average bundle. 2 feet Root.	A bundle of picked cane. 2 feet Top.	A bundle of picked cane. Next 2 feet.	A bundle of picked cane. Last 3 feet.	A bundle of Cane deteriorated by drought, Less 2 of Top.
Megass proper ...	7·63	8·47	8·3	7·58 (Fibre, &c. 7·36; silica, lime, and trace iron, ·22)	8·65 (Fibre, &c. 8·19; silica, lime and trace iron, ·24)	8·29	8·47
Sugar ...	10·63	13·31	13·37	9·49	13·64	13·85	10·41
Glucose ...	2·64	1·51	1·54	2·43	·736	·71	5·20
Ash ...	·307	·259	·233	·545	·363	·349	·352
Water ...	78·334	75·612	76·122	79·484	75·628	75·945	75·152
Unknown ...	·459	·839	·455	·471	·938	·856	·416
(Juice)	92·37	91·53	91·7	92·42	91·35	91·71	91·53
	100·000	100·000	100·000	100·000	100·000	100·000	100·000
The Expressed Juices analysing—							
Apparent Solids, *i.e.*, ° Balling ...	15·2	17·4	17·0	14·0	17·2	17·2	17·9
Sugar ...	11·51	14·55	14·58	10·27	14·93	15·11	11·38
Glucose ...	2·86	1·65	1·63	2·63	·808	·775	5·68
Ash ...	·339	·283	·255	·59	·398	·381	·385
Unknown ...	·497	·917	·485	·51	1·076	·934	·455
Equal to, in the 100 Apparent Solids—							
Sugar ...	75·72	83·62	85·76	73·35	86·8	87·84	63·57
Glucose ...	18·81	9·48	9·38	18·70	4·68	4·50	31·73
Ash ...	2·19	1·62	1·50	4·21	2·31	2·21	2·15
Unknown ...	3·28	5·28	2·86	3·66	6·21	5·45	2·55
	100·00	100·00	100·0	100·00	100·00	100·00	100·00

The large quantity of uncrystallizable sugar in the top is remarkable as compared with the rest of the cane, and the large quantity of "Unknown" in the middle as compared with the rest of the cane.

THE MEGASS, WATER AND SOLIDS OF ASKA CANES.

Determinations when actual marked thus*,—when by difference marked†.

	TOPS. Megass.	Water.	Soluble Solids.
Analysis of one bundle ...	*7·76	*76·1	16·14
	*7·76	*80·7	11·54
	*8·00	*80·32	11·68
	*7·00	†79·988	12·962
	30·52	317·108	52·322
Average	7·63	79·277	13·08

MIDDLE & ROOT.

	Megass.	Water.	Soluble Solids.
Analysis of one bundle, topped for sugar-house ...	*8·57	*77·18	14·25
	*8·00	*76·68	15·82
	*8·93	†74·77	16·80
	*8·40	†75·20	16·40
	33·9	303·83	62·27
Average	8·47	75·96	15 57

MIDDLE.

	Megass.	*Water.	Soluble Solids.
Analysis of a bundle—three analysis of the tops of which appear above	*8·68	†75·6	15·72
	*8·63	†75·7	15·67
	17·31	151·3	31 39
Average	8·65	75·65	15·7

ROOT.

	Megass.	Water.	Soluble Solids.
Analysis belonging to the three top and two middle analysis	*8·74	*76·44	14 82
	*7·64	†76 48	15·88
	*8 50	†75·80	15 70
	24 88	228 72	46 4
Average ...	8 3	76·24	15·46

Therefore, having on a bundle the separate average analysis of —

	Megass.	Water.	Soluble Solids
Middle—two analysis ...	8·65	75·65	15 7
Root—three „ ...	8·3	76·21	15 46
The body of the cane, by separate analysis of its middle and root, has an average analysis of	8 47	75·95	15·58
And the average of four analysis of a simply topped bundle was	8·47	75 96	15·57

And since the body of the cane is 5 ft. to the top 2 feet, we may see the average analyses of the whole cane is :—

Megass.

Tops ... 7·63 X 2 = 15·26
Body ... 8·47 X 5 = 42·35

57·61
Average ... 8·2

Water.

79·277 X 2 - 158·554
75·96 X 5 379 80

538·351
76·91

Soluble Solids.

Tops ... 13·08 × 2 = 26·16
Body ... 15·57 X 5 = 77·85

104 01
Average 14 86

And Megass=
Fibre and cellulose .. 8 0
Inorganic—chiefly silex and lime .. ·2

8·2

CARDAMOM CULTIVATION.

A VERY interesting paper has been written by Mr. Dickenson, Assistant Conservator of Forests, on the cardamom cultivation in Coorg, a subject which is not much known in this part of the country. This plant is indigenous in Coorg and the western coast, and has long been an article of commerce with foreign countries. Some years ago two English planters tried the experiment of cardamom plantations, but they found that the produce was so great in its natural state, that it was impossible to compete with those who were able to get it for nothing, or next to nothing. It is not likely that the experiment will be repeated. It is only during a portion of the year, namely from November to April, that these forests can be examined. Mr. Dickenson was only able to go through a portion of the forest during the time he was employed, but the part of the country that he took in hand seems to have been gone through thoroughly. These forests are situated, for the most part, on the western slopes of the ghat, there are very few on the inland side, and those few are situated to the north-west of Nalknad, together with a few locks in Kadyatond. Almost the whole of the western slopes are wooded except the upper part, where are belts varying in height from 500 to 1,500 feet, which are generally bare of forest or grass of any kind. The slopes are generally very steep, and the ground is covered with decaying leaves, the trees are numerous and grow to a great hight. Between the trees the ground is covered with leaves so that the sun rarely gets to it. The height and appearance of the cardamom vary in different parts of Coorg. Where the ground is cleared for cardamom cultivation, many kinds of plants and weed spring up at the same time as the cardamom plant, the seeds of which have been lying dormant in the ground with that of the cardamom plants. The cardamom plots are formed by felling two or three trees, the Coorgs being pretty well acquainted with the places where cardamoms are likely to spring up, after which the plant is left to grow, the only operation being to weed ; this is done at the annual period of picking the crops in the neighbouring clearings. After four or five years of crop, one or two more trees are felled, probably, because the branches of the surrounding trees have grown over the cleared area, and it is necessary to again let in the requisite amount of light. The plant begins to lessen in crop at about ten years, and the clearing is abandoned at about fifteen to twenty years, when the forest again grows up. An old garden seldom exceeds an acre.

Mr. Dickenson thinks that there is little fear of the forests deteriorating from the method of cultivation now in force, and he says, that it is a waste to let the land lie idle for years. It is thought that it would not be well to allow the wind to penetrate into the forest. With regard to the quantity of land that ought to be cultivated, the report before us says :—

"The Coorgs understand very well the danger of "killing the goose that lays the golden egg," the consequence of felling any large extent of forest for cardamom cultivation ; but to be on the safe side and in case the renters be tempted to open out the forest too much by another such a rise in the prices in cardamoms as occurred a few years ago, it would be a good plan to institute a rule by which only one cardamom clearing should be made to so many acres, say 1 to 30-40, these are only guess figures, and very likely the proportion might be safely increased. They might be easily fixed by measuring areas at present under safe cultivation. Another good check would be to fix the maximum area to which a clearing may be opened. I beg to point out however, that the conclusion I have at present come to from an inspection of a part of the ghâts is liable to be modified on an examination of the rest. But I have no hesitation in saying, that with the present low prices obtainable for cardamoms, there is no immediate danger whatever to be apprehended."

The clearing of forest unless the land is immediately taken up is deprecated, for when the land is cleared, if it is not at once cultivated, the forest does not re-assert itself, but a low scrub grows up which often takes fire in the hot season and which extends to the forest beyond. The consequence of the clearing of the forest is the diminution of the water supply of the district, and it ought to be the object of the Government to prevent as much as possible this being done. More especially, should the forests on the slopes of the ghâts, and near the sources of rivers be conserved. The Coorgs, we are told, are imitating their European brethren in clearing the forest, the high price of coffee tempting them to invest in this industry rather than allow the forest to stand as it has done for ages. It is likely that the subject of the depletion of trees will be brought under discussion at the assembly of the Commissioners to enquire into the cause of famine, and it is one that requires their most earnest attention.

THE INFLUENCE OF TREES ON RAINFALL.

DR. EDWARD BALFOUR, the late head of the Madras Medical Department, has furnished the India Office with a memorandum on the "Influence of Trees in India," which memorandum is being distributed in India for the benefit of the present generation of administrators. Dr. Balfour, tells us that he wrote and printed a paper on the above subject so long ago as 1840, and that in 1847 the Court of Directors called for information from India on the question whether the rainfall and productiveness of the soil were known to be influenced by trees. It was only from the Madras Presidency that any information was furnished to the India Office. It is interesting to note what the Madras Collectors had to say on this subject in 1848, or thirty years ago. Mr. Blane, Collector of Canara, denounced the way in which the forests were being destroyed, and recommended Government to preserve all forests which were not private property. Mr. H. Forbes thought there had been no appreciable decrease in rainfall, but that the water ran off more rapidly after forest clearances. Mr. Connolly, of Malabar, furnished the rainfall for 38 years, and showed that the amount had not decreased, though the clearance of jungle had been great. In North Arcot, Mr. Binning was informed that "the rains for the last 20 years or more, had not been so copious or regular in that district as in former days, and that, of late years, the jungles and supplies of water had gradually diminished." The people of Salem told Mr. Lockhart that "when the streams from the hills of Oollymally, Tullamally, and Ninamally were covered with jungles, the water was continually running, but after the jungles were removed and the lands were converted into nunjah and to totekal fields by means of reservoirs, wells and tanks, these natural streams had been affected." The Collector of Bellary noted the fact that Ramandroog Hills, 3,000 feet above sea level, was often surrounded with dense mist, when the plains below were dry and parched. Dr. Balfour, who first visited Ramandroog in 1845, and again in 1865, noticed on the latter visit, the great diminution that had occurred in the trees on its edge and sides. Dr. Balfour declares the railways have had much to do with our forest and jungle clearances. The Committee appointed by the British Association in 1851, consisting of Dr. Cleghorn, Dr. Forbes Royle, Captains Baird Smith and Richard Strachey, did much

to rouse Government to the necessity of protecting forests and planting trees. Among the writers who did good service in the establishment of Forest Departments, Dr. Balfour mentions Mr. Justice Innes, who issued three pamphlets on the subject, and urged the importance of planting the hills with trees wherever a tree would grow. We agree with Dr. Balfour that the public should be furnished with a comprehensive *resumé* of what the Forest Departments have done, with a view to determining whether the labours of the departments may not be profitably extended. The conclusion Dr Balfour comes to, after many years consideration of the subject is that [illegible] the present century, the rainfall has not diminished nor has the quantity annually falling become more uncertain [illegible] man, partly ignorant and wholly reckless, has denuded the soil of its trees and shrubs, and bared the surface to the sun's rays, thus depriving the country its conservative agents, and making the extremes of floods and droughts of more frequent occurence, and more severe.'

CULTURE AND USES OF THE CASSAVA.

THIS plant is a native of tropical America, where it has always formed one of the chief food resources of the population; indeed, it stands in nearly the same place in those countries that the potato holds in more temperate regions.

There are two distinct species, the sweet and the bitter; the fresh juice of the latter is a deadly poison, but [illegible] in the sweet kind. Boiling [illegible] to destroy the poisonous quality in the bitter kind, but that is not [illegible] depended on. The usual practice in the West Indies is to press [illegible] the juice and [illegible] it in the sun, or more commonly [illegible] constructed [illegible] the purpose, when thoroughly dry [illegible] perfect [illegible]

It is probable that this plant was introduced into Ceylon in the time of the Portuguese domination; it was certainly here in the time of the Dutch, and though it has never been much used, it has [illegible] Government [illegible] cultivation [illegible] attention to the growing of this plant, and for some years the cultivation [illegible] gradually extend [illegible] cocoanuts [illegible]

The usual mode of proceeding [illegible] the dry season and give [illegible] usual [illegible] kurakkan crop. Pieces of cassava stick [illegible] three feet [illegible] holes [illegible] distance when the first rain of the season has softened the soil sufficiently for the purpose. Over this the kurakkan is sown, when the monsoon rains have sufficiently saturated the ground. Four months afterwards the kurakkan is harvested, the surface weeded, and a slip of sweet potato vine stuck in here and there, and nothing more is required for twelve months, or rather nothing more is done except to guard more or less successfully against the depredations of cattle and wild pigs. The practice is to sell the crop on the ground at prices varying from two to six pice per bushel, the purchasers digging for themselves.

It would probably be a more profitable system to grow each crop by itself in succession, but the natives have their own ways and will neither learn nor forget anything. In one instance another plan has been tried, with what success remains to be seen. The roots of all jungle plants that survived the running fire were either dug out or their vitality otherwise destroyed. The cassava was planted in lines at five feet apart, the ground was regularly weeded till the plants met and shaded it and kept down all other growth. The estimated crop of this land is ten tons of roots per acre, and the time twelve months.

The fresh roots boiled eat very much like potatoes, both in taste and consistency, and are in this state wholesome food for man and all kinds of domestic animals. Pigs and cattle eat the raw-fresh roots greedily, and thrive on them. The dried roots moistened with water are good food for pigs and cattle, and ground and sifted, it makes excellent cakes and puddings; ground without sifting and moistened, poultry prefer it to grain. The fresh roots reduced to a pulp washed with plenty of clean cold water, and the fibre separated by a sieve, a pure starch will settle to the bottom of the vessel used, which rolled into pellets while moist, dried in the sun, and passed rapidly over heated metal plates, becomes the tapioca of commerce, an article which most people are acquainted with, as sold in the apothecaries' shops at a price too high for common use.

It is believed that the fresh cassava roots would pay the producer at 24s. per ton on the spot. It takes four pounds of fresh roots to make one dried, and the labour per cwt. will be at least 75 cents so that the corresponding price for the dried article would be 6s. per cwt. What pure starch, either in powder or the form of tapioca, could be produced for is beyond the present knowledge of the writer hereof, but with proper machinery it could probably be done to pay at from £6 to £8 per ton. The price in the London docks used to be 1½d. to 2½d. per lb.

As the roots soon [illegible] after two days; if, the[illegible] as an article of either [illegible] the dry state, and as th[illegible] when it can be depend[illegible] weeks in the year), per[illegible] cider mill to reduce [illegible] drying house, where art[illegible] thus doing in one day w[illegible] weather, and in wet [illegible]

Ceylon.

20 The proportion in [illegible] the mangels anal[illegible] table:— [illegible] a public, to all comers [illegible] second class the [illegible] Agriculture only; [illegible] ryots or their

NITROGENOU[illegible]

EVERY farmer who is i[illegible] feeding materials o[illegible] minoids,' or 'flesh former[illegible] of bodies similar in compos[illegible] the class of bodies bearing this name [illegible] highest importance. Animal tissues are largely made up of albuminoids; indeed, lean muscle almost entirely consists of these substances, which in consequence have received the name of flesh-formers. [illegible] albuminoids essential constituents of the animal body [illegible] present in all forms of vegetable growth, and without albuminoids no increase of plant tissue is possible. It is in the form of vegetable [illegible] that animals receive all the albuminoids afterwards stored up in their own bodies.

It is evident from [illegible] the [illegible] of albuminoids contained in [illegible] great practical importance, the feeding value of a food will in fact depend a good deal on the quantity of albuminoids present. [illegible] great importance of albuminoids that a statement of their quantity is to be found in every analysis of feeding materials.

Unfortunately chemists have not till quite recently possessed any accurate and speedy method of ascertaining the quantity of albuminoids [illegible] sample of food. They have consequently been forced to determine a single constituent of the albuminoids—the nitrogen, and to calculate from the amount of nitrogen the quantity of albuminoids present. Now as all albuminoids contain a constant, and nearly uniform percentage of nitrogen it is perfectly safe and accurate to calculate from the amount of nitrogen in food the amount of albuminoids which it contains [illegible] substance containing nitrogen is present. In the case of [illegible] and of most kinds of seeds, nearly the whole of the nitrogen present really exists in the form of albuminoids in such cases the calculations of the chemists are fairly accurate, and the albuminoids stated in his report are with slight difference, actually present in the food. When, however we turn to succulent foods such as roots or green fodder, the analyst's calculations are entirely at fault. Here, as in other cases, he is accustomed to multiply the nitrogen present by 6·25, and to consider the product thus obtained as the quantity of albuminoids present in the roots or hay. The conclusion is, however, erroneous, as vegetable foods of this class contain several nitrogenous bodies besides albuminoids; to reckon the whole of the nitrogen as albuminoids will, therefore, greatly exaggerate the amount of albuminoids really present.

It is only within the last few years that we have obtained any accurate knowledge of the various nitrogenous bodies present in roots. Previously to these recent investigations, it was assumed that the whole, of the nitrogen existed as albuminoids. The investigations in question have been carried out chiefly by E. Schulze, though with him other chemists have been from time to time associated. The roots examined have been chiefly mangel wurzel, and more recently potatoes. We will endeavour to give some account of the results arrived at.

In 1867 Schulze called attention to the large amount of nitrates contained in many roots. He determined the amount of nitrogen present as nitrates in mangels, sugar-beet, turnips, and carrots. The amount of nitrogen thus combined varied from 1 to 31 per cent. of the total nitrogen present. The largest quantity of nitrates was found in mangel wurzel. Besides nitrates Schulze found that the sap contained a small quantity of ammonia, varying in 14 analyses from 0·006[illegible] to 0·0285 per cent. of the fresh sap.

In 1875 Schulze published a far more complete investigation this time confined to mangels. He determined with great care the amount both of soluble and insoluble albuminoids, the quantity of nitrates, and also of ammonia. But, besides these ingredients, he now for the first time ascertained that mangel contain a large amount of soluble amides.* The exact nature of those amides he did not then ascertain, but merely the quantity of nitrogen which existed in this form of combination. He further showed that mangel contains another nitrogenous body—betaine, which Scheibler had already shown to exist in sugar-beet.

In 1877 Schulze published a further series of results, obtained with mangels of another season. This investigation included the change which takes place in the second year's growth of the root, when flower and seed are produced. In this investigation he ascertained the nature of the amide [illegible] abundant in mangels; he found it to be glutamin and associated with it a small quantity of another amide—asparagin.

* An amide is a body containing nitrogen in the form of amidogen—NH_2.

... with these various nitrogenous bodies occurred in ... by Schulze will be seen from the following

Analysis of ... for sug...

	1,000 parts of fresh mangel contained.	
	Roots of 1874.	Roots of 1875.
Albuminoids, insoluble	6·950	1·028
" soluble	2·306	1·413
Glutamin and asparagin	4·060	4·425
Betaine	1·359	0·226
Nitric acid	3·863	2·483
Ammonia	0·080	0·085

With the exception of the insoluble albuminoids, the whole of these nitrogenous bodies exist in solution in the sap of the root. The manner in which the nitrogen was distributed among these various bodies will be seen more clearly from the next table, where the total nitrogen in each mangel is taken as 100, and the distribution of this among the various nitrogenous bodies is shown. The mangels of 1874 contained 0·2400 per cent. of total nitrogen, those of 1875 contained 0 1979 per cent.

	Nitrogen of each constituent in 100 of total nitrogen.	
	Roots of 1874.	Roots of 1875.
Albuminoids, insoluble	6 33	8·29
" soluble	15·38	11·42
Glutamin and asparagin	32·15	42 80
Betaine	6·71	1·36
Nitric acid	36·28	32·54
Ammonia	2·75	3 59
Total nitrogen	100·00	100·00

The quantity of nitrogen existing as albuminoids is seen to be comparatively small; in the first mangels only 21·71 per cent. of the nitrogen present is in the state of albuminoids, in the second mangels 19·71 per cent. When analysing other mangels less rich in nitrogen, Schulze found a somewhat higher proportion of the nitrogen in the state of albuminoids; the proportion was in one case 29·79, and in another 37·92 per cent. of the total nitrogen present. It is plain that if these roots had been analysed in the usual way, and the whole of the nitrogen calculated as albuminoids the quantity attributed to the mangels would have been three to five times in excess of the truth.

Nitrates are apparently a very variable ingredient of mangels, sometimes reaching a very large proportion. In the analyses now referred to the nitrogen as nitrates formed from 9·46 to 44·06 per cent. of the total nitrogen.

The nitrogen existing as amides is in every case a large proportion of the whole. The principal amide-glutamin was not isolated by Schulze, he only obtained the acid (glutamic acid) which is formed by the splitting up of the amide. He obtained in the same way asparatic acid, formed by the splitting up of asparagin. These acids are proved by his investigation to have existed in the original sap as amides. Both glutamic and aspartic acids are known as products of the decomposition of albuminoids, and are thus plainly related to them.

Betaine is present in small and variable quantity; it diminishes as the root approaches maturity. Scheibler found 0·234 per cent. in the sap of sugar-beet on July 1; this quantity had fallen to 0·084 per cent. by October 1. Betaine is, very curiously, identical with a substance known to exist in the brain, and called by its discoverer oxyneurin.

We have said enough to show the complicated character of the nitrogenous ingredients of roots, and the fallacy of assuming that the whole of the nitrogen present is in the form of flesh-formers. In a second paper we hope to describe the results which Schulze has obtained with potatoes, and his investigation on the part taken by the amides and nitrates in plant nutrition.—R. W. in *Agricultural Gazette*.

FIELD EXPERIMENTS WITH POTATOES.

We are indebted to Mr. Wilson, Chapelhill, Berwickshire, for the following very interesting report of experiments conducted by him last season:—

During the season I have made some experiments on Victoria potatoes, which may prove interesting to some of your readers, if you will allow me space to give the results. On March 15th I planted a field partly with whole potatoes of second size as usually dressed for seed, and partly with cut sets, *viz*, potatoes of medium size cut in two, lengthways, no potato being cut into more than two sets. The portion planted with cut sets braided about ten days earlier than the whole, came away more regularly, and in fact had a more luxuriant appearance throughout the season, from which I expected they would prove the heavier crop. This I attribute to the cutting of the potato causing earlier decay, and consequently more rapid growth; and this is borne out by the fact that in lifting the crop this week the whole sets are many of them intact, while not a vestige of the cut remains. So marked was the difference throughout the summer, that many thought the whole sets had been inferior seed. They were, however, the same seed, and only separated the day before they were planted. The crop lifted as follows (per imperial acre):—

	Tons.	Cwts.	Qrs.	Lbs.
Whole Seed	10	18	2	18
Cut seed	9	1	1	3
In favour of whole seed	1	17	1	18

Whole Seed.		Cut Seed.	
Ware ...	84·622	Ware ...	73·411
Seconds...	11·062	Seconds...	18·573
Chats ...	4·316	Chats ...	8·016

The victoria bearing such a heavy crop of apples, I formed the opinion that the maturity of these must exhaust the strength of the plant, which ought to go to form tubers, and this induced me to cut the blooms off a few drills to prevent them forming apples. This I did when they were in full bloom, and again ten days later, when they showed a tendency to bloom a second time. The consequence was they continued growing, and became much stronger in the haulm than other parts of the field, and were so observable up to the time of lifting as to attract the attention of casual passers by. The following is the result:—

	Tons.	Cwts.	Qrs.	Lbs.
Bloom cut off produce	10	8	0	14
" left on "	9	1	1	24
In favour of bloom cut off	1	6	2	18

Bloom cut off		Bloom left on.	
Ware ...	87·502	Ware ...	78·824
Seconds...	9·706	Seconds...	15·132
Chats ...	2·792	Chats ...	6·044

These are the *average* results of six separate experiments in different parts of the field; and in every instance the result was decidedly in favour of the cut bloom; indeed, it was quite apparent to the eye, without recourse to the steelyard, that the crop was superior both in quantity and quality. The drills tested were immediately adjoining, in some instances one on each side of that from which the blooms had been cut. I hope this may induce others to try further experiment in the same directions next season.

IMPROVEMENT IN NATIVE AGRICULTURE.

A CORRESPONDENT signing himself MUKKUKANNADI writes to a Madras paper:—

"From your issue of Monday, I see that the late Colonel Vertue recommends, as a partial remedy for denudation of forests, that villagers should be induced to plant trees. This might easily be done, if they only knew where to plant them, as every one at all acquainted with them knows how readily they adopt any simple means of improving their cultivation, if the advantages to be derived are clearly demonstrated to them. Now they are always eager to obtain leaves of trees (to burn down into manure, or simply to place on the land, there to rot), and may be seen out in the open country sweeping together the leaves of avenue trees, &c.; and one constantly sees in their fields heaps of manure, consisting chiefly of the stalks of plants, leaves, &c., carefully placed ready to be ploughed in or spread over the land. They are also willing to pay for loppings of avenue and other Government trees, to be used as firewood. In fact on the west coast (and probably on the east coast also,) if allowed to do so, they would strip avenue trees of every leaf they have, for manure, or even cut down every tree for firewood. I think we may assume, then, that if assured of getting the leaves and loppings, they would willingly plant any number of trees near their holdings, the only trouble required being to put in a bough (which is quite sufficient, though not perhaps the best way of proceeding), and perhaps to water the saplings thus obtained, now and then. Now for this, there ought to be sufficient room in every village; because, theoretically, 30 per cent. of the land of every village ought to be reserved for communal purposes. And further, if such rough and ready saplings were planted at regular intervals on the boundary of this land, left uncultivated for common use, it would check the suicidal practice, almost universal I believe, of ryots continually encroaching on this 30 per cent., and would drive them back from absorbing the pasture land, to cultivating more highly the land they have. Cases are continually cropping up in which ryots are found cultivating parts of such waste land; on investigation it appears that the piece in question is almost surrounded by lands already cultivated and entered in *puttahs*, and so is less eligible for communal purposes, as not being easily accessible. So, in a weak moment, the division officer allows it also to be entered in the cultivator's *puttah*, and once entered in a *puttah*, it is not interfered

with. There are few villages where the orthodox 30 per cent, is reserved, and as a consequence the pasture land of the village decreases in extent yearly; eventually, perhaps, it is so hemmed in by cultivated lands (the village path to it also being by this time absorbed in some one's holding) as to be inaccessible, and the cattle of the village have to be driven farther afield which gives extra facilities for cattle thefts. So much for planting and pasturage.

"There is one means of supplying the ryots with manure which is not nearly so well developed as it ought to be, and that is by managing properly the sweepings, &c., of towns. The paddy and grass which come from the soil, are taken to the town and there absorbed as food; but nothing is taken back to replace them, while the animal and vegetable manure produced in the country itself does not count, as it does its own share of exhausting the soil, (the vegetable part having come straight from the soil, and the animal part being derived from grass.) Looking then at the enormous amount of fertilising elements annually sunk in food, without any return whatever to the soil; what can we expect but gradual impoverishment of the soil? The natural corrective, *i.e.*, the alluvial matter which washes down from the hills, must apparently diminish in quantity, year by year, unless the supply is inexhaustible, which there is no reason to believe; and as this corrective is less effectual every year, and the population, the exhausting element, increases every year, the process of impoverishment must go on with ever increasing rapidity. I think the action of animal life in connection with food may be described as follows. Leaving fish out of the reckoning, as they are so to speak on a separate establishment, we may assume that all food for man or beast comes from the soil, directly or indirectly; corn and vegetables and grass being an instance of the former, and flesh of sorts, an instance of the latter. All this comes from the soil. Now where does it go to? What becomes of it? It will be admitted that after being taken as food, it is changed either (1) into part of the animal's body, or (2) into something which passes off at daily or lesser intervals, or (3) into gas (such as carbonic acid gas, &c.) which passes off as breath. Part No. I. will, unless the animal be human, probably return to the soil when the animal dies; but if it be a man, the loss to agriculture at its death may be two-fold, *i.e*, (*a*) the body itself will not return to the soil, and (*b*) in the case of Hindoos, a large quantity of fuel (generally about Rs. 100 worth) will be lost, and its place have to be supplied by cowdung which ought to go into the soil. The loss to agriculture by the human body not being utilised, has been much dwelt on by scientific men and others, especially in connection with the question of cremation in Europe. It is, however, perhaps hardly to be expected that human feeling on this point will ever yield to arguments of utility, but all the more need on that account to guard carefully against waste in other ways. Part No. 3 (the gas) is largely utilised by plants, and is perhaps almost essential to their existence. But the most important item is no doubt No. 2; for that which a man casts off in a lifetime is much greater in quantity than what is left when he is dead. If then the whole excreta of the town of every sort, sweepings, &c., were utilised as manure, the impoverishing process would be greatly checked, and we might here in India last out very well till we can afford to import artificial manures. One question, however, requires consideration; that is, whether the present cheap supervision of Municipalities really pays. How can the President or Vice-President of a Mofusil Municipality find time and energy to work out the problem of utilizing all the off scourings of the town? Would it not be better, instead of making the whole thing a burden to some official, or some half-hearted unpaid private individual, to employ a paid Vice-President on a substantial salary, say of Rs. 200 or Rs. 300 a month? Probably the saving by efficient supervision would almost pay the extra cost, to say nothing of the benefit to health and agriculture. There is another point one would like to mention, if this letter is not already too long, and that is that it might be a good thing if steps were taken to provide agricultural literature for the benefit of non-professional men who are in the way of teaching ryots to do better, if they only knew anything of the subject themselves. Could not Mr. Robertson, or some other practical man, bring out a hand-book on agriculture (with special reference to Indian acquirements,) if necessary in monthly parts? Probably two hundred subscribers would be enough to pay expenses, and considering the number of revenue officials, there ought not to be any difficulty in securing that number."

PLOUGHING COMPETITION AT SYDAPET.

A HIGHLY interesting spectacle in connection with educational progress in this Presidency was witnessed at the Government Experimental Farm at Sydapet. The annual ploughing competition came off and attracted a pretty good number of visitors, including the Hon'ble W. Hudleston, Mr. Justice Kernan, and Colonel Macdonald. The public were thus afforded an opportunity of judging how far Mr. Robinson's efforts to introduce and render popular an improved method of ploughing among the natives of the country have succeeded, and also of contrasting the working of an English plough with that of the rude implement used by the agriculturists of India. Prizes at the competition were offered to three classes of competitors. In the first class the competition was open to the public, to all comers to persons on the farm as well as outsiders; in the second class the competition was restricted to students of the School of Agriculture only; and in the third class the prizes were competed for by ryots or their labourers only.

The following were the prizes awarded :—

CLASS I.

1	A Swedish plough ...	Rs.	25
2	An American " ...	"	20
3	Implements or seeds ...	"	15
4	Do. do. ...	"	10
5	Do. do. ...	"	5

CLASS II.

1	A Swedish plough ...	Rs.	25
2	An American plough ...	"	20
3	Implements, or seeds, or agricultural book ...	"	12½
4	Ditto ...	"	7½

CLASS III.

1	An American plough ...	Rs.	20
2	Money ...	"	10
3	Ditto ...	"	5

The judges in the different classes were :—

Class I.—Mr. L. B. Burrows, Mr. J. H. Garstin, and Mr. J. F. Price.

Class II.—Dr. Cornish, Major Bertie Hobart, and Mr. H. E. Sullivan.

Class III.—Mr. L. A. Campbell and Dr. F. G. Shaw.

A plot of ground containing six hundred square yards was allotted to each competitor, and the judges in awarding the prizes took into account the regularity and straightness of the furrow, the depth, the speed in executing the work, and the general finish of the work. For the competition in class II., there were thirteen students of the school, and they competed in two batches, the seven first getting through their work, and six afterwards. The competitors in this class were apprentice hands who have not received a training for more than three months; yet it was gratifying to find them manifesting considerable skill in working the plough. Some excellent work was shown, and an interesting fact in connection with the competitors in this class is that some of them were graduates of the Indian Universities. It is certainly a great advance in the history of agriculture in this country to find B. A's, who once only aspired to some post under Government, turning their hands to the plough and thus setting an example worthy of imitation by their countrymen. This pleasing result is due in a great measure to Mr. Robertson's untiring efforts to make the subject of agriculture as important as he can in the eyes of the natives of the country. He must at first have experienced very great difficulty in getting the educated youth of the country to consent to take to the plough, but having now so far succeeded, there is no doubt that the good result already achieved will tend to much further advancement. While the competitors in class II. were at work, the competitors in class III. also were engaged in an adjacent field. Here was an opportunity afforded for contrasting the working of the English plough with a native plough. It was easily perceived that the quality and quantity of work that can be turned out by an English plough is immensely superior to that done with a native implement. The English ploughs were easily dragged by the cattle employed, and, taking everything into consideration, there is no doubt that an English plough if substituted for a native plough will be a great saving to the person using it.

The competition in class I. was watched with very great interest. Fourteen competitors in all contended for the prizes offered, eight being ploughmen of the farm, one a student of the Agricultural School, and five outsiders. Those belonging to the farm used the cattle and implements of the farm, and outsiders had to provide their own cattle and ploughs. The ploughmen of the farm showed excellent work, and proved what English ploughs in the hands of trained men might be made to do.—*Madras Times.*

THE ARTESIAN WELLS OF PONDICHERRY.

PONDICHERRY, Dec. 4.

IN passing by the public garden of Pondicherry, you now can see at any time, especially in the evening, a large crowd of people, and you will suppose those Europeans and natives are promenading to admire the greenness of the trees and the variety of the flowers; but on entering the garden, you will be an eye-witness to the present great attraction of Pondicherry. The D. P. W. is at work digging an artesian well by a machine supplied with a complete stock of tools, costing Rs. 3,000 to the French Government. After a few days' trial, the drilling is going on with great success and celerity, and has attained the depth of 90 feet. The merit and honor of so important an enterprise must be given to M. Poulain. In spite of the little encouragement his scheme met with at first, this philanthrophic gentleman, moved by the disasters and mortality caused by the famine in 1877, resolved to devote all his energy to seek for the means of alleviating in future such dreadful horrors. At his own expense he made an experiment at Savana the most important cotton spinning-mill of this town, under his management. Although he used only a few,

imple tools, he obtained water on the 9th of September 1877, after eight months of constant labor, thwarted by several difficulties. Encouraged to dig deeper, when 159 feet (French measure) was reached, he discovered an abundant stream, giving per minute 220 litres (887 pints) of water. This spring is at 33 deg. of the centigrade thermometer, giving 7 deg. at the hydrotimeter, otherwise containing 710,000 of terreous salts. M. Poulain then searched in the compound of another cotton manufactory at Oppalam for a spring of water. After 86 days of easy digging, he found at a depth of 112 feet, a stream more abundant than that of Savanah, giving per minute 450 litres (702 pints) of a limped and slightly ferruginous water, showing 31° centigrade thermometer, and 9° of the hydrotimeter.

After these two successful experiments M. Poulain's ability is admired by every one, not excluding his former opponents. Now several native gentlemen are requesting his aid in the digging of artesian wells in their large fields, and he is just now at work in the village of Archipakum in digging his third artesian well. After the two years of dreadful famine we have just now experienced in the south of India, on account of want of seasonable rain, the success obtained by M. Poulain is of the greatest importance, not only for our little French territory, but also for the immense colony of our English neighbors. By the digging of wells in several places, the crops may be assured even if the clouds give no rain, and therefore the famine with its horrors can be in future removed or considerably reduced.—*Madras Mail.*

THE WHEAT CROP IN FRANCE.

FROM an article published in the *Bulletin des Halles*, it appears that the French wheat crop of this year amounts to 82,500,000 hectolitres, or twenty millions less than an ordinary average crop; this appears to be the general opinion, and the crop is therefore as bad as in 1873. The natural weight this year does not seem to exceed 74 killogrammes per hect., which constitute a further deficit, and reduces the total crop to 61,000,000 quintals (27,110,000 qrs.) Concerning the probable requirements and of the resources various countries during the present season, the *Bulletin des Halles* gives the following figures:—

	Imports required. Qrs.	Presumed surplus for export.
France	6,000,000	—
Russia	—	6,200,000
Italy	1,080,000	—
Great Britain	12,070,000	—
Austro-Hungary	—	2,250,000
Belgium	515,000	—
Portugal	175,000	—
Holland	620,000	—
Denmark	—	175,000
Sweeden	70,000	—
Switzerland	1,200,000	—
Norway	103,000	—
United States	—	13,800,000
Algeria	175,000	—
Sundries, including India	—	700,000
Total	22,858,000	23,125,000

Germany does not figure in this table, as it only exports from one part what it imports in the other.

GARDEN.

A CORRESPONDENT of the *Garden* says that some have an idea that a tree cannot be moved successfully without a large ball of earth being attached to the roots, but where there is not sufficient machinery for the purpose failure is often the result. The system of moving he recommends is to begin at some distance from the base of the tree, rather further, in fact, than is generally practised, and to comb the soil away from the roots, injuring them as little as possible. If a tree be gone properly round in this way, and the roots saved, success is perhaps more certain than when trees are transplanted with large balls. This can be taken as a contribution to the discussion of the important question of moving large trees. The success of the plan can only be demonstrated in practise.

THE insects that attack the orange tree are cocci, probably coccus hesperidum, a species pretty common to other plants as well as the orange. They can be destroyed by using either Fowler's insecticide, or Gishur's compound, or the following—soft soap, 2 lbs.; flour of sulphur 1½ lb.; tobacco, 1 lb.; and a wine-glassful of kerosene. Mix, and apply with a strong painter's brush. The destruction of these insects and the mussel scale so prevalent on orange trees should be commenced as soon as they appear as they do great injury to the trees, both by the extraction of juices and clogging up the breathing pores of the bark. The pests may often be avoided by destroying the gravid female coccus, who at periods may be seen climbing the trees and depositing her young. Try kerosene and water in proportion of three wine-glassfuls to seven gallons of water, and apply with a strong syringe. It is highly spoken of as an insect destroyer. Keep the mixture well stirred with the syringe while using.

WORMS IN FLOWER POTS.—A correspondent of the Irish *Gardener's Record* writes as follows under this heading:—"Have any of your readers tried mustard water for the purpose of destroying worms in flower pots? I have, and found it to answer admirably. A tea spoonful to a gallon of water is sufficient. I have never known it to cause the slightest injury to the roots of the most delicate plants. I advise any one troubled with this pest to give it a trial." We will give it a trial. There is one great advantage about the employment of mustard for this purpose, that as it is invariably kept in the house it is always handy for use; whereas lime, with which to manufacture lime-water is not always so available. Worms in pots are a great nuisance, but a humanitarian gardener has remarked, "earth-worms should never be ruthlessly destroyed; they are appointed by nature to ventilate the subsoil by boring in it channels for the ... [illegible] of air."—*Land and Water.*

BUFFALO HORN AS MANURE.—A few days ago we saw some chrysanthemums in pots that were very remarkable for the vigour and healthy appearance of their foliage, and on making enquiry we found that when the plants were shifted into their blooming-pots a good dressing of buffalo horn manure was given in the soil. We have heard of this as a most excellent manure for vines, strawberries, &c., and the appearance of these healthy chrysanthemums proves that it is well suited to them also. The shavings which constitute the manure are small, and a great deal of it is little better than powder; it readily mixes with the soil, and it is undoubtedly rich in nutritive properties. Unlike some of the chemical manures, it is free from injurious ingredients, and can be safely used by all classes of gardeners. We have ourselves made a few experiments with the buffalo horn manure, and are well satisfied with the result.—*Ibid.*

HINTS TO GARDENERS FOR JANUARY.

WATER all hardwooded plants, examine each plant, and those that need water should have enough to moisten each particle of soil. Should there be reason to think that the roots are "balled" with hard clay, pull up the plants and soak the roots in tepid water or uncover them and sluice them well with it. With regard to glass-house specimens, regulate the growth of Dipladenias, Stephanotis, Clerodendrons, other plants of a scandent habit, that, are grown into specimens. Those only starting into growth should be syringed frequently, and not have too much water at the roots. Ixoras should have bottom heat, either by being plunged in a hot-bed or stood on the surface. Rondeletia Speciosa is a grand subject when it has justice done to it. It must not be allowed to have too much water, but if it is allowed to become very dry, it will shed its leaves. Keep the Selaginellas in a shaddy part of the house to enable them to retain their fresh delicate green colour. Gloriosas and other tuberous-rooted plants will require more water as the young growths begin to show above the surface. Let nothing suffer for the want of water.

FORCING HOUSES.

Fig House.—Keep the syringe freely at work amongst the foliage to prevent its being infested with Red Spider, for it is impossible to have a good crop of fruit if the foliage is unhealthy. Free ventilation without the foliage being exposed to the influence of keen blasts of wind is an important point in fig growing. All suckers must be removed and very strong growths stopped at 4 or 5 leaves above the old wood. See that the borders are not becoming dry. Trees in pots must be encouraged with weak lime manure. A layer of half-rotted horse droppings on the surface of the soil will assist these.

Pinery.—The whole of the stock excepting recently-potted suckers and crowns should have a slight syringing on warm afternoons. Plants that are required to stand for fruitings must not have too high

a temperature, 75° or 80° for bottom heat must not be exceeded and 10° lower for top heat. Ventilate freely to keep the young growth stocky. As we write these notes there are some two score young plants within a short distance of us, along the shady side of a water course, for watering a compound, all doing well. A "Sucker" planted alongside stable manure under a shady wall, has turned out a strong and hardy plant far in advance of the others we mention. Altogether we incline to "shade" for Pine-apples, although the Superintendent of the Maida Vale Pinery in London having tried all kinds of experiments cannot say positively what circumstances are most favourable to the development of pines. As a matter of fact, in the West Indies and South America, they grow anywhere and any how.

Strawberry House.—Any glass shaded stand will do; expose the plants to light and air, or they will have flavourless fruit. Discontinue liquid manure, upon symptoms of the leaves withering.

Vinery.—Stop back all laterals to one joint beyond the main spur, and the later spurs to one or two joints beyond the bunch. Thin out the bunches before the berries become too large, or they become crowded and render the task difficult without injuring those that are to remain. Look after the inside borders, and maintain an abundance of atmospheric humidity. Mr. D. S. White, Kilpauk, Madras, has freely experimented on vines, and now possesses some magnificent ones, extending over 60 yards in length, on two sides of his bungalow, and supported on posts 15 feet high; the vines are then trained across a trellis work overhead, 15 feet wide, the walk underneath being deliciously cool and shady.

Flower Gardens and Pleasure Grounds.

Purchase rock plants, as their character may be seen in the foliage, and many are in flower now. Sandy loam is the best for filling the fissures of rock work for the general collections. Roses from pots can be planted out now, for another six weeks with success. If the plants come to hand in a free-growing state, keep them in a cool airy frame for a fortnight or three weeks, to well harden before planting. The wild rose from the ghâts can be grown in beautiful profusion on ornamental rockeries. Stir the soil of tulip beds and tread Ranunculus beds carefully between the rows. In dry weather water them well. A mulch of cocoa-fibre refuse or well decayed manure will render watering unnecessary. Tritomas can be propagated now by taking off the strong side-suckers and planting them in rich sandy soil. The seed of these plants ought to be sown soon in a cold frame or a very slight hot-bed. Sow four or five seeds in each pot, turn the seedlings out into the border with the ball entire, and take up and divide in the spring.

Kitchen Garden.

Cabbages are 12 annas and 8 annas each in Madras, and as to lettuces, they are as rare as the Dodo in its ancient haunts. The square miles of compounds full of weeds and rubbish are a standing monument of the passive obstinacy of butlers to prevent their master's cultivating even a mouthful of green food "out of the market" to stimulate their torpid livers. However, perhaps some of the "Benighted" may read, mark, and learn that, in December and January asparagus seed may be sown with safety. Every man requires 10 per cent. of potash in his blood and he may just as well get it by cultivating and eating asparagus as by paying a doctor for Eno's fruit salt. The young asparagus plants must be thinned out, as soon as they are large enough to handle. Where any of the second sowing of peas has missed through being destroyed by birds or mice, stir up the soil and plant asparagus. Sow vegetable marrows, cucumbers and melons in manure-beds. Always remembering that, such plants grown in a cool temperature are stronger than those in a hot; to plant them all in 9 inch pots saves time. Sow for succession peas, beans, lettuce cabbage, cauliflowers, endive and small salading. And if anybody, native or European, tells you "they won't grow," say, you mean to persevere them until they do grow.

POTTING AND TRANSPLANTING.

NEVER put a small seedling in a large pot; for it only looks lonely and out of place, but will not thrive as if placed in a thumb-pot. Roots are either annual, biennial, or perennial; and under all circumstances the fibrous parts (radiculæ) are strictly annual, and as the winter approaches decay or remain in a state of rest, as we term it, until spring returns, and then renew their vigour, which we perceive by the formation of new leaves. Plants or trees may always be more successfully transplanted when these fibres are in a state of decay; for, being of so tender a texture, there is always the liability of breaking and injury, from the hand of the amateur, and, of course, the removal will necessarily cause a cessation of labour on the part of the plant. They are dainty objects, and will rest after moving from their old home to a new one; and from them we may all learn many an invaluable lesson. Many of you last spring, after the toil and weariness of moving and house-cleaning, took no thought of the body needing rest, and now in the sultry days of summer feel the need of it, and acknowledge, when too late, that had you been more careful then you would not be obliged to suffer so dearly for your imprudence now. Always, if possible, transplant when these fibrous roots are in a state of decay, for the roots almost exclusively imbibe nourishment from these fibres, and in proportion as they are injured by the removal, just so much is the plant deprived of the means of support, for that sap which is now employed in the formation of new fibres would have served to increase the size of other portions of the plant. If your plant produces seed in large quantities, the fibrous roots exist only in a very limited number, and, *vice versa*, the production of seed, particularly in tuberous-rooted plants reduces the amount of root developed.

In nurseries I believe it is usually customary to prune the roots of trees which are being transplanted. If at any time a root becomes bruised, it should immediately be removed, lest it decay and thus affect the neighbouring parts, and may, if not removed, cause the loss of tree or plant. This operation should be performed in the fall, for then the roots, like the other portions of the plant, are comparatively empty of fluid; but if you wait till spring you rob it of much of the vitality which it has been hoarding up for its spring compaign, and thus retard the prospect of future success to a late day. If you wish some of your shy-blooming tuberous-rooted plants to bear seed, keep the tubers pulled off, for then the sap is thrown upward; and if, on the other hand, the tubers are desired, pinch off the blossoms. Some of us have been taught that it was much more difficult to obtain seed from the early potato than from the later varieties. By simply removing the tubers they will blossom, and give us as great an amount of seed as the late ones.

In watering plants or trees we are accustomed to pour it on the stem or body, and not on the ground surrounding it. Years ago a successful experimentalist discovered that by placing a radish in water it would imbibe freely if only the extremities were placed therein; but if plunged in entirely, imbibed but little and soon wilted. This fact explains why the skilled gardener waters his trees and shrubs at a distance from the trunk or stem. While recently watching the rain drop peacefully from the clouds, I thought perhaps this is why the leaves act as a roof for the large roots, collect the drops which run from one to the other, and at last fall from the outer edge, which serves as an eave, and brings the greater portion of moisture just where it is most needed to cause these fibrous roots to push forth and seek larger quarters. The food imbibed by the roots is slowly and with much labour carried to the vessels off the stem and branches, and there deposited. The roots usually are incapable of increasing the family of plants to which they belong. Still there are some exceptions, and certain species have the power of forming what are called adventitious buds, and are thus useful for the purpose of propagation. I believe there is no known rule to determine what species may be thus increased; and, therefore, experiment must be brought into practice. If at any time it becomes necessary to prune a root, leave it with a smooth, clean surface. If small roots are bruised they die back a little and then send forth new roots; but if the large ones, they lose their vitality, and, as their ragged tissues remain open to the frequent introduction of water, decay is the result, and the disease spreads to the healthy portions of the plant and death is usually the result. In many cases it is wise to remove a portion of the large root, and thus compel the plant to throw out young, active fibres in place of those which have for a season seemed inactive. Extensive growers of the gooseberry annually dig along their borders with a sharp spade and cut off the roots, thus causing the increase of branch and fruit. By careful observation we may always tell when the roots of our plants need more soil or new quarters. It is not necessary to remove the plant as soon as the roots begin to curl round the edge of the pot. Let them grow freely; but do not let them become dry and woody. They should be white and succulent. When changing a plant from a small pot to a large one, be particular not to destroy these tender fibres, and, after placing the ball of earth in the centre, pack the soil moderately firm in the space. After repotting stand the plants where they may have a free circulation of air around the pots, and the roots will be much stronger and more healthy, while that have stood crowded together have made but little progress in root formation or upward growth. Many times florists, instead of removing a plant to a larger pot, simply wash the soil from the roots and return it to the same pot, but in a new soil. This is why they use such comparatively small pots for large plants. By washing the soil from the roots the fibres are uninjured, and the plant can go on in its labour or forming leaves and blossoms; while if we break the soil from the roots we break the fibres also.
—*Fern Leaf.*

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 28th November 1878.

THE HON'BLE L. S. JACKSON, C.I.E., *President, in the Chair.*

THE proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members :—

The Superintendent, Botanical Gardens, Saharunpore, Mr. Charles Roberts, Manager of the Nohabarree Tea Estate, Assam, and Manager of the Punkabarree Tea Company, Punkabarree.

The names of the following gentlemen were submitted as desirous of joining the Society :—

Walter Knaggs, Esq., Trafalgar Estate, Singapore,— proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Edward Scarth, Esq., Ningri Ting Tea Factory, Assam,—proposed by Captain W. J. Williamson, seconded by Dr. E. Gray.

Baboo Grija Prosunno Mokerjee, Zemindar, Goburdanga,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

The Hon'ble Justice Wilson,—proposed by the President, seconded by Mr. W. S. Creswell.

CONTRIBUTIONS.

1. Transactions of the Asiatic Society of Japan, Vol. VI., Part 2. From the Society.

2. Journal of the Asiatic Society of Bengal, Part I, No. 2, and Part II, Nos. 2 and 3, 1878. From the Society.

3. A number (88) of rare mango grafts, and 12 lychee grafts prepared in his garden at Utterparah. Presented by Baboo Rajkissen Mookerjee. A special vote of thanks was accorded to the Baboo, for this acceptable donation.

4. A case of plants from the Botanic Garden at Signapore. Presented by the Superintendent.

5. A small quantity of seeds of tuberous *Begonias* and of *Momordica sanguinea.* From Samuel Jennings, Esq. (Transferred for sowing in the Garden.)

6. A packet of Geranium seed from Naini Tal plants. From T. M. Francis, Esq.—Transferred to Garden.

7. Four varieties of Patna millets. From John Scott, Esq.

8. Seed of the "Forbidden fruit." (*Citrus*—— ?) From the West Indies. From Col. W. M. Lees.

9. A few more seeds of the "Aki" (*Blighia sapida*) and of Ladak tobacco. From the Department of Agriculture, N.-W. P.

10. Four healthy seedlings of the tea plant from Assam. Presented by W. E. Smith, Esq.

GARDEN.

THE Gardener's monthly report was read as follows :—

" The weather having become more open during the month, the grass-cutting work of the coolies was somewhat lighter, which gave an opportunity for utilising their services in a more general way, making new roads, repairing existing ones, and tidying up for the cold season. As authorised, twelve extra hands have been secured for a time to prepa[re] flower-beds, repair roads, &c., as the original staff are all engaged in the afternoon watering which, as our water-supply stands at present, will always prove an heavy item nine months out of the twelve. Potting off young stock, fruit grafts, &c., taking off rose layers sowing seeds, and watering have occupied the *mallees'* attention, to say nothing of the D. O.'s, which are as brisk as ever. The Liberian coffee seedlings are, I find, of extremely slow growth ; a couple of seeds of the second sowing (sown 1st October 1878) have germinated. In this same pan I tried a few green berries, but otherwise firm and full sized, and apparently only requiring a few days more to colour, but they failed to germinate. This would seem to indicate that the berries must be left on the plants till they are coloured more or less. I have hopes that I shall be able to succeed better with the cuttings as soon as I get some bottom-heat in the propagating house. A case of plants has been received from the Singapore Botanic Garden, the plants being in fair condition. Consignments of various other seeds have been received and duly sown. A paper, shewing the percentage of germination of vegetable seeds in the trial sowings of 1878, is herewith enclosed ; they were all sown under exactly the same conditions. The seeds from Messrs. Sutton and Sons, of Reading, have certainly taken the lead in both germinating powers and robustness of the seedlings. A report of the germination of the imported flower seeds will be sent in next month."

The tabular statement of trial sowings shews that the English seeds have germinated best, and the American second, whilst [the] French and German have germinated but indifferently. It was agreed to reconsider this at the next monthly meeting, when the trial sowings of flower seeds will be submitted.

REPORT ON THE COMPARATIVE WORKING OF CERTAIN PLOUGHS.

THE following report from Dr. S. Lynch on the above subject was submitted :—

"I return herewith the plough you were good enough to lend me for the purpose of testing the draught when used on the light soil of the field attached to the Alipore Jail. The plough is one of Ransome's very light ones, its weight being only 84lb. The depth of the furrow was between five and six inches, and the width about seven. We found the draught when the plough was drawn by a pair of bullocks at their ordinary pace, was between 2½ and 3 hundred weight on land from which a crop of millet had just been cut. The bullocks used were average country animals, well fed, and accustomed to ploughing. The plough, with the same bullocks, was also tried on grass land which had never before been turned up—the site of an old village. Here the draught was as much as 4 cwt. to 4½ cwt. This was as much as the bullocks could manage, walking very slowly, and they could not have done a day's work at it. The land was wet and heavy.

" The work of a native plough was compared on the same grass land with that of the English plough ; the draught was found to be 1½ cwt.: such a trial is of little use, as the native plough is not intended to accomplish its end in the same manner as the English plough. It scratches the ground and has to go over the same surface repeatedly to get to the depth which the English plough reaches at once.

" One result of testing the draught of the native plough was that we found that bullocks, such as are used here in native carts, are equal to a draught of 1½ cwt. Anything more brought them to a stand-still. The work done therefore by the native plough is equal to the capacity of the country bullock when half-starved in the hands of the poor native.

" We also compared Ransome's plough with an American wooden beam plough with wooden handles, made at the jail from a pattern you were good enough to lend us. This plough weighs about 56 pounds (the weight varying according to the kind of wood used). The ploughshare is a bar of wrought iron, made to shift forwards as the point wears out. This plough turning the same furrow as to depth and width as Ransome's, but a broken one, whilst with Ransome's the work was beautifully even, the slice being turned completely over showed the same draught as Ransome's.

" Comparing the two ploughs as to cost, the American plough can be made here at from Rs. 12 to Rs. 15, whilst light English ploughs for a single horse or pony cost at home from £2-10 to £3, or in this country, from Rs. 45 to Rs. 50. The difference, then, is altogether in favour of the locally-made wooden plough, which turns out just as efficient work, though not so good to look at as the English one, which is far lighter,—56 lb. against 84 lb.,—and can be made at one-third of the cost of the English plough."

RESULT OF SOWINGS OF "REANA LUXURIANS" AND "LUCERNE" IN THE AGRA DISTRICT.

The subject next introduced was a communication from the Manager of the Agra Ice Company regarding the cultivation of Lucerne grass and Reana luxurians :—

" Some of the seeds of Reana luxurians, with which you kindly furnished us, sown in April last 6 feet apart, produced 30 to 40 seers weight of fodder at first cutting in September. Seeds sown in October of last year, surviving the winter and one sharp white frost on 6th January this year, yielded a first cutting in April and a second in October ; but on the whole we think the soil more profitably employed with Lucerne, which, *except in the rains*, when indigenous weeds and excess of moisture seem to choke it between them, yields a fair cut, even on our poor soil, monthly, and doubtless with manuring (which we purpose) the plants, which are now springing into a vigorous resuscitation quite refreshing to the eye in this dull brown barren looking locality, will exceed their former outturn. A plot sown in September 1876, nearly killed by the long drought of 1877, yielded early in this year repeated cuttings of 24 to 30 inches in length, and good substantial thickness of stalk in 25 to 30 days ; in one case we noted 30 inches in 21 days. We have abundance of water and irrigate so as to keep the surface from absolute dryness ; beyond this, this plot had no manure until later on. The soil is a mixture of sand, yellow loam, and small *débris* of building—poorest stuff.

" We note these facts as they may interest you, or serve to inform some one who wants to know about Lucerne, which strangely enough seems little known in this district."

PROGRESS OF COFFEE AND TEA CULTIVATION IN THE ANDAMANS.

Read the following extract of a letter dated 10th November, from Mr. O. H. Brookes, on the above subject :—

" I went to inspect the tea plantation at the new clearing on Saturday last. The plantation is situated on rising ground about 150 feet above the level of the sea ; there are about four acres of land under tea cultivation, and there are approximately about 10,000 plants. The first beds planted look remarkable healthy ; they were planted out about

March, and are now on an average about 18 inches high, and have thrown out four and five stems each. These plants were raised from China seed. There are also Assam plants of more recent planting and consequently lesser growth; but these too are looking strong and healthy; the plants are planted about five feet apart: field rats are destructive to the small plants, but the introduction of cats will prevent this to a great extent. The coffee plantation at Mount Harriet is in a flourishing condition. I have seen some of the plants almost breaking with the weight of the berries; there are about 120,000 plants, and of these there are about 30,000 now in bearing, and we anticipate a crop of from 8,000 to 10,000 lb. of coffee this season, so we shall hereafter be well off in coffee and tea. Sugar could be manufactured in large quantities, as the cane grown here is excellent. In 1881, when all the coffee plants will be in bearing, we ought to get a crop of 50,000lb. of coffee."

REMARKS ON THE PAST SEASON IN THE BENARES DISTRICT.

The following communication from Mr. C. Nickells, of Pussena Factory Jounpore, was next submitted :—

"At the monthly general meeting of the Society held on the 24th October, under the head "Horticultural Notes," a letter was read from your Benares correspondent. He says,—"The damp is excessive, and again such rains have not visited Benares for ten years." I am an indigo planter, and my experience tells me, and I am sure all planters will agree with me, that the past rainy season has been an *excessively light one* with two exceptions,—*viz.*, 1873 and 1877. The showers were few and far between, and the heaviest fall did not exceed 2½ inches; the damp was certainly not excessive, and the little rain that did fall came at the right moment, which was the principal cause why the *khurreef* crop was so fine.

"I cannot agree with your correspondent about the past being the heaviest rainy season within the last ten years. The years 1874 and 1875 were indeed heavy rainy seasons; in those years the rains began early and left off late. It rained sometimes for a fortnight at a time, and five to ten inch showers were of common occurrence. In the flat lands water flowed out of the wells, and of course the *khurreef* crops were an entire failure: even the succeeding *rubbee* did not do well owing to the lands not being ploughed sufficiently.

"I don't think the crops (*rubbee*) will be fine this year unless rain falls soon. There is hardly any moisture in the ground, at least not sufficient to mature the crops."

Letters were read—

From Col. M. H. Lowther: a few hints in connection with a *Gardner's Note Book*.—Transferred for journal.

From T. M. Francis, Esq.: the substance of a paper in the *American Agriculturist*, regarding a novel mode of putting down cuttings of hard wooded plants—Transferred for Journal.

From Samuel Jennings, Esq., a few notes on tuberous *Begonias*.—Transferred for Journal.

From the Deputy Conservator of Forests, Tounghoo Division, applying for a quantity of tea seed for the Thandoungyer plantation.—To be complied with.

From the Secretary, Royal Horticultural Society, London, returning thanks for certain seeds.

Before the meeting separated Mr. James Caldwell drew the attention of members to a collection of forty-four water colour paintings, full size, of as many varieties of sugarcane collected by him in New Caledonia in 1869 and 1870, for the colony of Mauritius. The whole of these, with many other kinds from other localities, were introduced in Wardian cases, to renew the original cane plants previously cultivated, which had so deteriorated, from long and exhaustive cultivation, as to bring the sugar industry and the colony to the verge of ruin. The result was completely successful, and the orginal outlay advanced by the Government was not only fully repaid, but left a considerable surplus. The paintings now exhibited were made in New Caledonia from the plants, as actually collected, by Madame de C. Moon, a distinguished amateur flower painter (who has largely illustrated the botany of Mauritius), and from their truthfulness and finished execution, they form a singularly interesting collection, as remarkable for their unexpected varieties of colouring and form as for their novelty.

The best thanks of the meeting were accorded to Mr. Caldwell for the exhibition of these drawings, which were much admired, and for his remarks thereon.

Mr. Caldwell kindly consented to allow the portfolio to remain for some weeks in the Society's rooms for the inspection of those who take an interest in sugarcane cultivation.

AGRICULTURAL SHOW IN KHANDEISH.

TO BE HELD AT MAHEJI FAIR, KHANDEISH.

Opening day, Monday the 3rd February, 1878.

ALL articles including Live Stock must be delivered not later than Saturday the 1st February at Maheji, after which date they will not be received. This does not apply to vegetables and such like perishable articles which will be received up to the morning of the opening of the Exhibition or up to date of examination.

All articles intended for exhibition, should be consigned to the care of the mamledar at Maheji.

The Exhibition will be open to the public on Monday the 3rd February 1879, but the first few days will be occupied by the Committee in judging &c. Prizes will be awarded on Saturday the 8th February.

No prize will be given in any class unless the stock exhibited comes up to a fair standard of excellence.

Committee reports to be sent into the Collector by Friday morning (7th February) by the latest.

Mamledar to be informed by the Judges of their awards not later than Friday morning (7th February) so that arrangments made be for getting the money ready &c.

A.—HORSES.—30 *Prizes. Total Rs.* 1,695, *for bona fide native breeders.*

		Rs.
1.	For brood mares over 14 hands, the produce of any Government stallion and in foal to, or with foal at foot, by a Government stallion. If "in foal" to be not less than 4 years or "with foal" not less than five years old. There prizes of Rs. 150, 100 and 50	300
2.	For brood mares of any breed not less than 14 hands and one inch, with foal by a Government stallion, or covered by a Government stallion. Four prizes of Rs. 100, 60, 40 and 20	220
3.	Colts one year old and under two, by Government Stallions. Three prizes of Rs. 60, 40 and 20...	120
4.	Geldings two years old and under three (any country breed) Three prizes of Rs. 75, 50 and 25...	150
5.	Ditto three years' old and under four (any country breed). Three prizes of Rs. 125, 75 and 40	240
6.	Fillies one year old and under two, by Government stallions. Three prizes of Rs. 60, 40, 20	120
7.	Ditto two years old and under three, by Government stallions. Three prizes of Rs. 75, 50 and 25	150
8.	Ditto three years old and under four, by Government stallions and likely to become a good brood mare. Three prizes of Rs. 125, 75 and 40	240
9.	Tanga Ponies, geldings, 13 hands and under, not being the property of a stipendiary Government servant. Two prizes of Rs. 40 and 25 ponies to be sold if claimed up to 80 rupees the pair	65
10.	Country bred ponies, geldings 13-2, and under and not more than 8 years old. Three prizes of Rs. 40, 30 and 20 ...	90

(No prizes to be given to prize-takers of previous years for the same animal and under the same head, neither can an animal get a prize under more than one head).

A hand is equal to 4 inches.

Entire colts or ponits allowed to compete as geldings, if the owners agree to geld them at Maheji.

B.—CATTLE—26 *Prizes. Total Rs.* 605.

11.	Best bull of any breed and independent of age, one prize	50
12.	Country-bred bulls over *two* and under *four* years of age, 3 prizes of Rs. 40, 20 and 10	70
13.	Milch cows, four prizes Rs. 30. 20, 15 and 10	75
14.	Field bullocks, nine prizes of Rs. 50, 40, 35, 30, 25, 20, 15 10 and 10	235
15.	Bull buffaloes, two prizes of Rs. 20 and 15	35
16.	Milch buffaloes, three prizes of Rs. 35, 20 and 15 ...	70
17.	Bull calves by Government bulls, or bulls bought from the *herd*, 2 prizes Rs. 20, 15	35
18.	Cow calves by Government bulls, or bulls bought from the herd, two prizes of Rs. 20 and 15	35

C. GRAIN AND SEEDS.—39 *Prizes. Total Rs.* 495.

(Each competitor to exhibit *fifteen* seers, certified to be the produce of a Survey, number of not less than 2 acres in his holding.)

19.	Wheat. 3 prizes of Rs. 20, 15 and 10	45
20.	Gram, 3 prizes of Rs. 20, 15 and 10	45
21.	Rice indigenous, 3 prizes of Rs 20, 15 and 10	45
22.	Rice Carolina, 1 prize Rs. 20	20
23.	Bajri, 3 prizes of Rs. 15, 10 and 5	30
24.	Jowari, 3 prizes of Rs. 15, 10 and 5	30
25.	Linseed, 3 prizes of Rs. 20, 15 and 10	45
26.	Tilly, 3 prizes of Rs. 20, 15 and 10	45
27.	Any other oil seeds of Khandeish, 3 prizes 20, 15 and 10 ...	45

(For the following, each competitor to exhibit *ten* seers certified to be the produce of a Survey number of not less than two acres in his holding.)

28.	Tur, 3 prizes of Rs. 15, 10 and 5	30
29.	Kulthi, 3 prizes of Rs. 15, 10 and 5	30
30.	Urid, 3 prizes of Rs. 15, 10 and 5	30
31.	Mug, 3 prizes of Rs. 15, 10 and 5	30
32.	Peas, 2 prizes of Rs. 15 and 10	25

D. COTTON—17 *Prizes. Total Rs.* 320 *and a Gold Medal.*

(Each competitor to exhibit 25 seers grown in Khandeish, certified produce of one field.)

33.	Cotton, Hinganghat variety uncleaned, 4 prizes, 2 of Rs. 25, and 2 of Rs. 20 each	90
34.	Ditto Dharwar ditto 4 prizes, 2 of Rs. 25 and 2 of Rs. 20 each	90
35.	Ditto Hinganghat, cleaned, 4 prizes, 2 of Rs. 20 and 2 of Rs. 15 each	70
36.	Ditto Dharwar ditto 4 prizes, 2 of Rs 20 and 2 of Rs. 15 each	70
37.	For the best of all samples of cotton exhibited, a gold medal or cash Rs. 100	100

E. Fibres—18 *Prizes. Total Rs.* 210.

(Each competitor to exhibit ten seers.)

38.	Hemp (saun), 3 prizes of Rs. 20, 10 and 5	35
39.	Hemp (Ambari), 3 prizes of Rs. 20, 10 and 5 ...	35
40.	Aloe fibre, 3 prizes of Rs. 20, 10 and 5	35
41.	Cotton stock, fibre (Palkati) 3 prizes of Rs. 20, 10 and 5 ...	35
42.	Jute fibre, 3 prizes of Rs. 20, 10 and 5	35
43.	Other ditto ditto	35

F. Tobacco—12 *Prizes, Total Rs.* 220.

(Each competitor to exhibit 10 seers certified produce of one field).

44.	Tobacco indigenous grown in Khandeish 6 prizes, 2 of Rs. 25, 2 of Rs. 15 and 2 of Rs. 10	100
45.	Tobacco exotic grown in Khandeish, 6 prizes, 2 of Rs. 30, 2 of 20, and 2 of 10	120

G. Dyes,—3 *Prizes, Total Rs.* 45.

(Each competitor to exhibit *ten* seers which must be certified to be a fair sample of two maunds.)

46.	Indigo prepared in Khandeish, 1 prize of Rs. 20 ...	20
47.	Al. 1 prize of Rs. 15	15
48.	Kusumb, 1 prize of Rs. 10	10

H. Sugar Cane and Sugar—19 *Prizes, Total Rs.* 385.

The former to be exhibited in samples of *fifty* canes, as certified samples of the produce of not less than an acre.

The latter in samples of one *bhili*, approximating a *maund* in weight.

49.	Mauritius or Nagar Dewla canes, six prizes of Rs. 35, 30, 25, 20, 15 and 10	135
50.	Black canes, four prizes of Rs. 25, 20, 15 and 10 ...	70
51.	Khudia canes, three prizes of Rs. 20, 15 and 10 ...	45
52.	Goor prepared in Khandeish, 6 prizes of Rs. 35, 30, 25, 20, 15 and 10	135

I.—Roots and Vegetables—14 *Prizes, Total Rs.* 63.

(To be exhibited in samples of not less than five seers.)

53.	Potatoes common, grown in Khandeish one prize ...	20
54.	Ditto sweet grown in Khandeish (Ratalas) one prize ...	5
55.	Onions Ditto ditto ditto ditto ...	5
56.	Wangi Ditto ditto ditto ditto ...	3
57.	Chillies-grown in Khandeish, one prize ditto	3
58.	Carrots Ditto Ditto ditto ditto	3
59.	Garlic (lasen) Ditto ditto ditto ..	3
60.	Beet root Ditto ditto ditto ...	3
61.	Turnips Ditto ditto ditto ...	3
62.	Lettuce Ditto ditto ditto ...	3
63.	Nohlkohl Ditto ditto ditto ...	3
64.	Cauliflower Ditto ditto ditto ...	3
65.	Cabbage Ditto ditto ditto ...	3
66.	Tomatoes Ditto ditto ditto ...	3

J. Textile Fabrics—14 *Prizes. Total Rs.* 135.

Not less than 3 pieces of each description of fabric to be exhibited, by each individual competitor, for a prize under any class, and to be certified by the *mamledar* of the *taluka*, that they are *bona fide* Khandeish made by the exhibitor, or his family.

Fabrics to be sold if claimed for the price fixed in the class under which they compete.

67.	Sarees of the value of Rs. 12, one prize	15
68.	Ditto ditto 6 ditto	7
69.	Ditto ditto 3 ditto	6
70.	Dhoties of the value of Rs. 12, one prize	15
71.	Ditto ditto 8 ditto	11
72.	Ditto ditto 4 ditto	7
73.	Turbans of the value of Rs. 18, one prize	16
74.	Ditto ditto 7 ditto	10
75.	Ditto ditto 4 ditto	7
76.	Carpets, two prizes of Rs. 20 and 10	30
77.	Simple Dungree, one prize	5
78.	Double ditto one prize	5
79.	Country Blankets, one prize	5

K. Carts &c.—6 *Prizes. Total Rs.* 150.

80.	Baggage carts exhibited for sale at a price not exceeding Rs. 40, to be sold if claimed, two prizes of Rs. 30 and 20	50
81.	Riding carts exhibited for sale at a price not exceeding Rs. 40, to be sold if claimed, two prizes of Rs. 30 and 20	50
82.	For the best tanga or cart on springs to be for sale, two prizes of Rs. 30 and 20	50

L. Miscellaneous—2 *Prizes. Total Rs.* 40.

83.	For the best lac not less than five pounds in quantity and gathered in Khandeish, one prize	20
84.	For the best set of native field implements consisting of 1st Nagar (plough) 2nd Wakhar (hoe) 3rd Kolpe (weeding hoe) 4th pamer (seed depositer) one prize .	20
	Total Prizes Rupees ...	1,460

FORESTRY.

In view of the circumstances brought to light in the report of the Neilgherry Forest Reserve Commission and otherwise forced on the notice of Government, the Governor of Madras in Council resolves to direct that no application for Forest or Shola land be entertained on the Neilgherries until the whole district has been reported on, and the general question of land reservation, whether forest or grass land, been considered, and future policy decided. Any such applications addressed to the Commissioner will be registered for future disposal.

The endeavour made to cultivate trees other than those indigenous to Mysore, in some of the Government fuel plantations, does not appear to have met with encouraging results. Experiments were tried with the Carob, Mahogany, Red Saunders, Sal, Wattle (Acacia Dealbata) Gum Trees, (E. Robusta and E. Globulus). Australian, Blackwood and Silk Oak (G. Robusta). The Carob has grown well and so have the Mahogany, of which seven only have been planted; the Eucaplipti have suffered a good deal, specially the small plants. The Grevilla Robusta (Silk Oak) does not appear to have been tried on a large scale; a fine cluster of these trees is to be seen near the slaughter-house in the Cantonment, but the tree is not fit for fuel or timber. To make plantations a source of future revenue, steps ought to be taken to sow trees broadcast, by means of ploughing—pitting out is an expensive process, and transplanted trees do not grow so robust or quick as seedlings left to themselves. A good specimen of this kind of forest-making may be seen near Jacoor, where a tract of land was so dealt with by Mr. Ricketts some years back and is now a dense growth of fuel.—*Bangalore Spectator.*

Some of the difficulties which will attend the management of arboriculture by the Department of Agriculture, have already been noticed in these columns. It is a hazardous experiment for one man to control and direct the scattered operations of a province comprising nearly fifty districts and nearly five hundred tehsils. It is doubtful whether any more satisfactory results will be obtained than under the old system, by which Collectors with a fancy for tree-planting got a good deal done through the tehsildars. After all the new system throws on Collectors the task of carrying out operations decreed by the Department, and superadds the risk of possible friction with public works officials. A grant is made to the former for planting and to the latter for maintaining avenues. The question naturally arises when is the responsibility of maintenance to commence? The district officer may gaily spend his pittance of five hundred rupees in planting a first-rate avenue, which he will hand over to the P. W. D. to maintain out of their still more insufficient allowance. Trees will die, who is to replace them? The Collector vows he handed over strong and healthy trees to the District Engineer; the latter recriminates perhaps that the trees were made over insufficiently protected, or, as is the fashion now-a days, surrounded by vast trenches that are no protection against the active goat, and may drain off the moisture from the roots of the sapling. No doubt all these points can be disposed of by a few simple rules, but the period of transition in management is not likely to have been favourable to arboriculture. *Apropos* of arboriculture, it should be recollected that it is not enough to stick a sapling, however strong, into a hard dry soil. The ground should be thoroughly broken up to a considerable, depth, and where the avenue passes through *usur*, the sterile soil should be replaced by good earth from a neighbouring field (very little is required). Heat above and drought below kill thousands of trees, especially deciduous trees (such as the shisham, &c.) Water should be given plentifully, and a good top dressing of old manure will stimulate the growth marvellously. Free planting is but a form of gardening, and we may look in vain for avenues if their nursing is left to the care of an ignorant road coolie. Planting must be limited by the funds available for thorough superintendence.—*Pioneer.*

SUBMERGED FOREST ON BOMBAY ISLAND.

Observations by G. E. Ormiston, *Resident Engineer, Bombay Port Trust, dated 29th May* 1878, *(communicated by Government).*

The strata exposed in the excavation for the Prince's Dock consist of the surface silt or black mud, which overlies to a depth of from 4 to 5 feet a dense blue clay of varying thickness (from 6 to 20 feet), but nearly level on top; underneath this is found loam, moorum,* and rock; the latter is very irregular on the surface, running at times into long narrow ridges and masses of boulders with

* A local term for decomposed rock.

soil between. The rock is soft, and consists mostly of indurated clay nodules imbedded in a hard matrix. Numbers of trees have been found (about 260 up to date). Many had been overturned before being covered with the blue clay, but the roots were only partially torn out of the loam or moorum in which they grew, others were standing upright with their roots deeply planted in their native soil. The standing trees only extend to the surface of the blue clay, none penetrated the muddy silt above ; and for a foot or so below the level of the blue clay, the timber was riddled by the *Teredo navalis*, or a similarly destructive worm. Most of the other trees also showed signs of this worm. One tree was found charred on one side for a short distance. The largest trunk found was 46 feet long and 4 feet 8 inches in girth ; some of the timber is quite sound ; it is of the colour of dark rose-wood, and with a straight grain. The level of the roots of these varied from low-water extreme spring tides to 12 feet under. This shows the land to have subsided at least 30 feet, as the trees must have grown above high-water mark.

NOTE.—This discovery of trees, in the spot on which they grew, below low-water mark in Bombay Island is chiefly remarkable, because it shews that, in recent or sub-recent times, depression must have taken place in the immediate neighbourhood of ground which appears to have been raised. The Prince's Dock is on the eastern or harbour side of Bombay Island, and the Esplanade surrounding the fort on the western side, not a mile away from the dock, is composed of the rock called littoral concrete by Dr. Buist, a mass of shells, corals and sand cemented together by carbonate of lime. It is scarcely possible that the materials of which this rock consists can have been accumulated at their present elevation above the sea; in all probability they formed, when first deposited, a sand bank or beach not raised above high-water mark, and as it is difficult to understand how elevation and depression can have occurred simultaneously on different sides of so small an area as Bombay Island, it is probable that the whole area has undergone elevation and depression alternately. If the elevation be the older movement, then the Esplanade must once have been several feet higher than it now is ; if the depression is older, the trees at Prince's Dock have been at a greater depth beneath the sea than they now are. The former is perhaps more probable.

The such alternate movements of elevation and depression have taken place in Bombay Island was shewn by Dr. Buist* many years ago, though to a smaller extent than now appears probable. At the same time, before the depth to which depression has extended in this case can be estimated, it is necessary to ascertain what kinds of trees are represented. If they be such as grow on land, the depression must have been greater than if they belong to such forms as *Avicennia* or *Bruguiera*, which grow some feet below high-water mark. The circumstance that the trees are bored by Teredo is in favour of their having grown in salt marsh, where these mollusca are peculiarly abundant.

W. T. BLANFORD.

MINERALOGY.

THE WYNAAD GOLD FIELDS—MR. SMYTH'S REPORT.

No. 1616 of 11th November 1878.

READ the following paper .—

From R. BROUGH SMYTH, ESQ., Mining Engineer to the Secretary to the Government, Revenue Department,—No. 169, dated Devalah, the 5th November 1878.

I have the honor to submit, for the consideration of His Grace the Governor in Council, the fourth report of my proceedings.

2. I have much satisfaction in stating that on the 17th October, gold was found in large quantities in a quartz vein about thirty chains south-easterly from the Alpha Mill, near an adit known as "Wright's Level."

3. The strike of the reef at the point where the "run" of gold occurs is nearly north and south, and the vein dips rather rapidly to the east. The average thickness of the vein is about four feet, and throughout a thickness of two feet or more ; the stone is veined and seamed with sesqui-oxyd of iron derived mainly from the decomposition of pyrites. Fine gold is disseminated throughout the blocks of stone which have been taken out, and it occurs also in well-defined layers associated with the ores of iron. When the blocks are broken, numerous jagged pieces of gold are seen, and thin leaf-like forms are found in some parts.

4. The yields of gold from the stone obtained at this spot have been as follows :—

		oz.	dwt.	gr.	
1.	No gold visible in the stone ...	0	11	6·0	per ton of 2,240lbs.
2.	No gold visible in the stone ...	2	16	1·6	ditto
3.	A little gold to be seen ...	56	13	19·5	ditto
4.	Gold visible in the stone ...	204	11	16·7	ditto

None of the richer specimens have been treated.

5. The "run" of gold appears to be transverse to the lines of the dip and strike of the reef, and I anticipate that at a greater depth, and at points north of the places where the rich stone is found, auriferous quartz will be discovered that will give good returns.

6. In an adit below Wright's Level, and nearly due east of the point where the richest specimens have been got, parcels of pyritous quartz has given an average yield of 3 dwt. and 23·04 grains per ton.

7. At the Skull Reef, about twenty-two chains north of Wright's Level there is a great thickness of quartz. It measures about fourteen feet from the hanging wall to a mass of 'floating rock' (country), but the total thickness has not yet been ascertained. Here there is at the face much stone that is practically unproductive. The reef has been carefully tested in five sections (vertical), and the yields, per ton 2,240lbs. were as follows :—

	oz.	dwt.	gr.
No. 1 Section.—Hanging wall one foot in thickness ...	0	0	16·19
No. 2 Section.—Hanging wall three feet in thickness ...	0	0	9·92
No. 3 Section.—Hanging wall four feet in thickness ...	0	1	2·20
No. 4 Section.—Hanging wall five feet in thickness ...	0	2	2·21
No. 5 Section.—Hanging wall six inches in thickness ...	0	0	4·25

8. It will be observed that the stone in the fourth section gave somewhat better yield than that from the other sections, and on tracing this line northwards along the strike, stone was obtained which yielded at the rate of 1 oz. 4 dwt. and 5 grains per ton.

9. Here, as in nearly all other cases, the gold is associated with sesqui-oxyd of iron, but clean gold in almost iron-free quartz is seen in some places.

10. The increased yield at the last-named spot appears to indicate the setting in of another band of auriferous quartz.

11. From a reef about forty-five chains south-easterly from the Devalah bazaar, I have obtained quartz which yielded in several sections as follows :—

	oz.	dwt.	gr.	
No. 1 Section ...	0	0	0 ...	Button not weighable.
No. 2 do. ...	0	9	1·91	per ton.
No. 3 do. ...	0	2	4·40	do.

The quartz from this reef contained a not very large proportion of pyrites.

12. Due west of this reef, and about twenty chains from it, there is an outcrop of auriferous quartz, and gold is also found in the soil near the reef

13. At the Cavern Reef, about twenty-six chains east of the Alpha bungalow, the native miners have made (for them) rather large adits, having evidently followed the direction of the pyritous seams, nests, and joints which are found there somewhat abundantly. These openings, as I am, informed, and from my own observations believe, have been worked, only to a very small extent, under the supervision of Europeans. The reef presents good prospects as indicated by the yields, which are as follow :—

		oz.	dwt.	grs.	
1.	Quartz	0	2	21·80	per ton.
2.	Pyritous quartz (the proportion of pyrites being large)	0	19	3·00	do.
3.	Pyritous quartz	0	10	2·59	do.
4.	Ditto	0	11	4·90	do.
5.	Ditto	0	8	5·60	do.
6.	Ditto	0	14	11·00	do.

This reef will be further tested as soon as other urgent work now in hand is disposed of.

14. A sample of pyrites which it is said was taken out of the Ettacu Reef (a portion of which has been laid bare by the Wynaad Prospecting Company, and which was formerly worked by the natives), has yielded at the rate of 2 oz. 1 dwt. and 7·78 grs. per ton. I have examined the abandoned workings at the Ettacul, and I have failed to find any mineral similar to that which I treated, but I have not yet had any quartz broken out. There is, however, no doubt, from the evidence I have obtained, that highly auriferous pyrites and pyritous quartz occur at this point.

15. The results here given are to my mind highly satisfactory, but any one result, whether large or small, if considered by itself and without reference to other facts connected with it, would be altogether misleading.

16. There are numerous reefs in the neighbourhood of Devalah, reported as auriferous, which I have not yet had the opportunity of examining, but quartz was taken from one reef some miles north of Devalah bazaar, and about four miles west from Nelakotta, when I was surveying there, and gold was found in it.

17. I have marked on the lithograph map of the three amshoms of South-East Wynaad (scale one inch to the mile) partly from my own observations and partly from information afforded by gentlemen resident in the districts, the position, approximately, of ninety outcrops of quartz veins, and west of Choladi, intersecting a line about fourteen miles in length, there are said to be eleven distinct reefs. It is not to be supposed, however, that during the short time I have been in the Wynaad I have been able to ascertain the position of all the reefs. There are many blank spaces on the map.

18. The position of the reefs is being marked down also on the Trigonometrical Survey map (on the scale of four miles to one inch), and from one reef three miles north-east from Vellirymulla, I am assured by a gentleman resident there, and who is acquainted with the reefs near Devalah specimens of auriferous quartz have been obtained as rich as any found in this

* Transactions of the Bombay Geographical Society, Vol. X., p. 177, 1857.

neighbourhood. My informant has been so good as to offer to point out the reef from which the gold was taken.

19. It may be regarded as certain that an area measuring twenty-five miles from east to west, and thirteen miles from north to south—three hundred and twenty-five square miles—is intersected by quartz veins in this district alone.

20. The great thickness of many of the veins and the formation of the country—which is such as to admit of the quartz being mined economically, no deep shafts or heavy expenses for the drainage of the mines being necessary,—have to be taken into consideration when the number of reefs is looked at and an estimate of the auriferous resources of the district is to be made.

21. Nor should the extensive, but shallow, workings of the native miners who sought for gold in times past be forgotten. Their small excavations and pits are found all along the lines of outcrops of the quartz veins, and in many places the soil not usually more than two feet in depth from the surface to the bed-rock, has been carefully washed.

Their "races," the lines of which are now nearly obliterated, and the ruins of their aqueducts, made for the purpose of conveying water to the mines, are to be seen in some parts of this district. All these tend to show that the miners found remunerative employment in mining both in the reefs themselves and in the soils containing the *debris* and *detritus* of the reefs.

22. It is not possible as yet to indicate the reefs that are distinct from each other, to show on the maps those that are continuous. Any attempt to indicate the main lines of reefs from a superficial examination of the country must necessarily fail. Such can be done only after a proper survey has been made, and the position, the strike, and the dip of each outcrop ascertained.

23. Korambars have been at work washing earth by ground-sluicing north and north-east of Devalah, and in some places they have obtained rough gold, which indicates the existence of reefs that in all probability will yield well. In one place a "*leader*" was cut by the Korumbars, a portion of which showed gold, and, if approved of, I shall continue to prospect with the aid of the native miners in order to discover the auriferous reefs.

24. The Korumbars have been working lately near Needle Rock, and I have also commenced box-sluicing in the same locality. There was some delay in obtaining suitable timber for making boxes, but those that have been made will be sufficient for the purpose intended.

25. There are two quartz reefs at Needle Rock which I have examined, and which are shown on the key-map, and the proprietor of the estate has informed me that he has sought the permission of His Grace the Governor to name one the "*Buckingham Reef*" and the other the "*Chandos Reef.*"

26. I have purposely omitted to this progress report all reference to the mineralogical facts observed, and other details which, unless instructed to the contrary, I propose to mention in my final report.

27. The weather during the past month has been favourable, and it continues fine, and I have hope that I shall make rapid progress with my field-work. On Saturday next, the 9th instant, I propose to go down the Carcoor Ghaut, and to visit the mines near Murdainy. It is said that the season is now favourable, and that any delay might result in my finding it difficult to induce persons to accompany me to a locality which is reported to be unhealthy in the succeeding months. I trust that this proposal, though interfering to some extent with my work here, will be approved of.

28. I continue to receive information and cordial assistance from every one, resident in the district, who is aware of the nature of the work I am engaged on, and it affords me pleasure to state that Mr. Thomas Laing, the Quartz Miner, and Mr. G. E. Withers, assistant, perform their duties to my entire satisfaction.

29. On Thursday, the 21st October, His Grace the Governor was pleased to inspect numerous specimens of auriferous quartz obtained from the Alpha Mine, and to observe also the method of testing the stone by amalgamation. On the same day, His Grace visited and examined the reef at that point where the rich quartz has lately been discovered.

On Friday, the 1st November, those interested in mining were honored by His Grace's visit to Needle Rock, where gold was got both by box-sluicing and ground-sluicing.

30. On Saturday morning, the 2nd November, I had the honour to take His Grace's wishes respecting the mode in which I should conduct the investigations I have been appointed to make, and venture to entertain the hope that the final result of my labours may in some measure obtain His Grace's approval.—

OOTACAMUND, Dec. 9.

A CORRESPONDENT writes to the *Madras Athenæum* "The residents in this district, as S. E. Wynaad is now in the limits of the same, take considerable interest in the question of gold mining. We gather from the public prints that the *Madras Athenæum and Daily News* does not look at this enterprise in the sanguine manner that others do. Having had unusual opportunities of inspecting the Wynaad gold reefs and their outturn where marked, I have come to the conclusion that a company with a large amount of capital should make a good thing out of quartz crushing in S. E. Wynaad, but that an enormous amount of capital is required to crush with profit, as the gold is, as a rule, thinly distributed over a large bulk of stone—the gold is generally almost invisible. So that peculiarly expensive machinery is required, not only to extract the gold, but to retain it when extracted. The gold is much mixed with other metals and the separation of it from them is difficult. All "surface gold" (with collection) has been long since picked up by the natives of the land. "Washing for gold" cannot, therefore be profitably carried on. I observe that Mr. Brough Symthe is reported to have found reefs which yield at the rate of 204 oz. 11 dwts. 16·7 per ton. I think you are right to call this a ridiculous yield per ton of stone; a ton was not crushed to get this yield—a piece of stone with a quantity of gold in it was chipped off and weighed—and the calculation was made as if a whole ton of quartz had been crushed, and 204 oz. 11 dwts. 16·7 of gold had been found scattered over the ton. But even had a ton been crushed, and so much gold found scattered over it, the test of the capability of the reef would not be a sound one. At least 1,000 tons of quartz should be crushed and the average struck to ascertain the correct average yield of a reefs. The Companies which have been working for some years have crushed in the aggregate over 1,000 tons, so that there should be no difficulty in ascertaining the correct average yield. I have just seen 7lbs. of clean coffee taken off a tree in this district, as there are 1,200 trees planted to the acre there, the owner of the estate might boast that his estate yields at the rate of 8,400lbs. per acre, *i.e.*, nearly 4 tons per acre! But alas the other 1,199 trees have yielded in this acre so miserably, that the aggregate amount of yield from them is under 300lbs. Such being the case, would the proprietor of the estate be justified in advertising his estate for sale as yielding at the rate of 8,400lbs. per acre—because one tree has yielded at this rate? I fancy the said proprietor would be much laughed at if he published the assertion, so I quite agree with you that it is simply ridiculous to assert that your gold-fields yield at the rate of 204 oz. 11 dwts. 16·7 grs. per ton of quartz, because a chip of quartz yielded so much gold; had that said chip weighed 2·240lbs. instead of 4lbs., the yield of gold would have been 204 oz. 11 dwts. 16·7 grs.

Exaggerated statements of this nature will bring contempt on us—but the careful examination of the Wynaad gold reefs which I have personally made, leads me to the belief that a truthful assertion of unvarnished facts will do much good—and will bring capital into our district to work our reefs on the large scale which can alone ensure their remunerating capitalists.

If the yield is now exaggerated—a reaction must, sooner or later, set in—and our last state shall be worse than our first—a panic will arise and capitalists will be frightened from the safe investment, gold mining, *i.e.*, "quartz crushing" in S. E. Wynaad really does present.

A PEKING correspondent corroborates the report that Li Hung-chang has contracted with Mr. Arnold Hague, of New York, an able geologist and mining expert, for the purpose of prospecting for gold, silver and other minerals in the north of China. This he says has been effected on the suggestion and through the efforts of the American Consul and Vice-Consul at Tientsin. Mr. Hague is now in Tientsin, and will shortly take his departure for the mining regions. Our correspondent finds in the development of the resources of China the panacea for Chinese emigration to California.

AMERICAN PETROLEUM.—The total export of American petroleum from 1861 to, and including 1877 (16 years) is given at 442,699,968 dollars custom house valuation. From the best sources of information there are at this time 10,000 oil wells, producing and drilling, which, at a cost of 5,000 dollars per well, would make an investment of 50,000,000 dollars in this branch of the business. Tankage now existing of a capacity of 6,000,000 barrels cost 2,000,000 dollars and 7,000,000 dollars, have been invested in about 2,000 miles of pipe line connected with the wells. The entire investment for the existing oil production, including purchase money of territory, is something over 100,000,000 dollars, which amount cannot be lessened much, if any, for as wells cease to produce, new ones have been constantly drilled to take their place.

The Planters' Gazette.

TEA.

THE endeavours of Mr. Burrell and others to place pure Indian teas within reach of the general mass of consumers in Europe, and to educate, so to speak, the public taste for unmixed Indian teas, will make it less and less necessary for agents and brokers to urge the managers of our tea estates to manufacture the great bulk of their teas into "rasping tea."

To manufacture a "rasping tea" means to sacrifice all delicate aroma, all fine finish, in fact all that constitutes a "fine tea", fit for general and immediate consumption, in order to make a "bitter tea", that is unfit to be drunk by itself, and only serves as an admixture to low class China teas, without which they would probably not be saleable. It is a matter of congratulation that in spite of this great demand for "rasping tea", there is still sufficient fine tea turned out in India to sustain the good name, Indian tea has been making for itself, and as the demand by consumers for pure

Indian teas is increasing now rapidly, the evil of deliberately manufacturing an inferior tea from good leaf, will, no doubt, find its own remedy. Managers cannot be blamed. They as a matter of course, must comply with the instructions they receive from the agents. In manufacturing "rasping tea," the process of fermentation is checked untimely, and the leaf is partly fired, the result being a strong biting tea, which may perhaps be termed a kutcha tea,—such a tea however as the brokers want, but not an article that will do credit to India should it come pure to the consumer. As a rule however such tea does not reach the consumer, except as a component part of a mixture, consisting of perhaps one-part of this tea and six of China Congou or inferior Souchong.

According to official returns, the total area of land under tea cultivation, in the year 1876-77 (these returns are inexcusably late), amounted to 145,685 acres, showing an increase of nearly 21,000 acres over the recorded acreage of the previous year. We suspect, however, that some portion of the increase exists on paper only, and is due to imperfect returns in the year 1875-76. Assam shows up for 102,711 acres, Bengal returns 30,242, the North-Western Provinces 4,709 acres, the Punjab nearly the same, and Burmah ends the list with a solitary plantation of 150 acres, situated near Akyab. Nearly half-a-million acres of land have been taken up for planting, but are not yet planted, and a good deal of this will probably never be planted, being either unfit for cultivation, or reserved for the supply of timber and fuel to the plantations.

A third edition of Lieut. Colonel Money's work on "The Cultivation and Manufacture of Tea," has recently been published by Messrs. W. B. Whittingham & Co., 91, Grace-church Street, London. The body of the work is an essay for which the prize of the Grant Gold Medal and Rs. 300 was awarded by the Agricultural and Horticultural Society of India, in the year 1872. The book has since then been greatly enlarged and corrected by the experience of the past six years.

We give prominence to the following from the *Indian Tea Gazette* :—" Speaking of the necessity for the production of teas with the requisite quality and flavour to suit the taste of the English market, it cannot be too strongly impressed upon agents and managers that it is essential to pay more and more attention to the adequate manuring of the land. Poverty of soil means, we know, in many cases, poverty of the proprietor ; and it is not, of course, always easy for an owner to expend what he would desire to do in the way of enrichment of the soil. But seeing that too often inferior quality is due rather to exhausted soil than to imperfect cultivation or manufacture, and that where the former is the case, the only profitable remedy is judicious expenditure in the improvement of the land, it will prove short-sighted policy if every effort be not strained in this direction where the fact of the necessity is at all apparent."

It is said that the mosquito blight this season has proved a terrible pest, and the loss to proprietors in consequence has been most serious. Many promising estates this year have proved short 25 to 30 per cent. of their outturn from this blight.

A NEW ENEMY TO THE TEA PLANT.

Among the pests of the tea plant may be reckoned an apparently new insect, in the form of a caterpillar, which has lately shown itself on an estate on the Nilgiris. The owner of the estate experimented on a few of them, picked off his trees, and the following are a few particulars :—

(1.)—The caterpillar is about an inch long with five pairs of legs in addition to a pair where the body points off at the stern.

(2.)—It has a small cream-coloured head with a pair of minute black eyes, and has the power of drawing in its head, which it does when it comes into contact with any suspicious object.

(3.)—It is of a bright salmon colour, growing to a pinkey colour on the stomach. It is marked with one, and in some cases with three, black stripes down the back. Those having three stripes are, to all appearance, the older insects.

(4.)—Each insect has, on its back, a number of protuberances which correspond to the number of its legs, and which taper to a minute point. This is the most notable point of physical peculiarity, for through each of the protuberances the little creature emits a drop of bright transparent fluid as soon as it is touched on the back with a straw or stick ; and when it does so, it looks as if it has so many drops of dew resting upon it.

(5.)—It feeds voraciously upon the tea leaf, and in four or five days, half a dozen have bared a large bush of every leaf. They do not, however, touch the young buds, for the reason, probably, that there is more of tannin in them. This, however, is merely conjecture.

(6.)—The owner of the estate on which the caterpillar was found kept also a few in a bottle to watch their habits and development. Of the small number of five insects which were placed in a tart bottle with a perforated cork, and a small supply of tea leaf, frequently changed, four died and dried up against the side of the bottle, and only one underwent a metamorphosis, and has been kept in a separate phial without any further change being noticed for more than three weeks. It located itself before the change along the centre of a tea leaf on the upper side, and drawing the leaf into a fold, spread over itself a covering of a brownish color and of the consistency of a dense cobweb. It has remained in that state ever since.

(7.)—The insect when alive crawls by folding its body up and using alternately the front and back halves of its body to seize the branch along which it travels.

(8.)—Wherever it crawls it leaves a web behind it, in the same way as many caterpillars do, but the web it pays out is so strong that it requires some pressure to move or break it.

(9.)—The body of the insect is very tough, and when shaken off the tree it was difficult to kill even by rubbing with a stick, so that each insect had to be cut in two with a knife.

(10.)—The drops of liquid which it casts out through the pores on its back are also of a property which causes a cobweb to stick to anything to which the liquid attaches.

Probably some scientific people could throw light upon the nature of the insect and tell us if we are to look for a new pest in this shape, or whether it is an evil which is not likely to spread and assume ruinous proportions. A bottle full of these insects were submitted to the Commissioner of the Nilgiris, who was kind enough to promptly send them on to the Board of Revenue, who have science more ready to hand and are better able to help to determine the nature of the pest.

TEA IN CEYLON.

Much as writers on the subject of tea cultivation may differ on some subjects, they are at least agreed on the matter of altitude, and, indeed, it needs no practical acquaintance with the subject to understand that as the tea planter looks for his crop from repeated flushes of leaves, those flushes can only be obtained under circumstances favourable to a free development of vegetable organisation. This cannot take place in a region of continued cold with a low rate of rainfall : frequent showers and a tolerably high temperature, without being of a too forcing character, constitute the conditions most favourable for a succession of flushes. It has been laid down as an axiom by tea planters of experience, that the plant may be cultivated with profit within a range of several thousands of feet, and that whilst a high altitude gives quality, a low elevation is favourable to quantity. To what extent this rule holds good in Ceylon, and how far the experience gained in Assam may be applied to this island, are points which are yet open to discussion.

There is one matter, however, upon which we believe there is no room for doubt. The fact is indisputable that the soil of Assam is far superior to most of that to be found in Ceylon. The Assam plantations have been formed out of forests, the soil being a rich vegetable loam, free from stones and gravel. This well established fact should induce caution on the part of any who may be contemplating the planting of tea on land whereon coffee has ceased to be productive ; at the same time it may be well to bear in mind the opinion of agricultural experts who declare that, although land may have been exhausted of the elements necessary for the support of one variety of plant, it may yet contain the essential constituents of food for other growths. This point will be put to a practical test before very long, as there are at the present time portions of abandoned coffee estates under tea cultivation in several districts. Time alone can determine if the quality of the leaf produced be satisfactory, and whether such soil will continue to yield flushes sufficiently abundant to be remunerative.

To what extent aspect, soil, rainfall, and altitude will together or separately affect the quality, yield, and durability of tea plantations, has yet to be ascertained. The great variety of conditions under which tea is being cultivated in Ceylon, will, before many years shall have elapsed, supply us with such data as shall shew, beyond

doubt, what are the conditions favourable to the profitable cultivation of tea in Ceylon. That tea may be grown in this island, and exported at a price or prices that will leave a profit to the grower, we do not for a moment doubt, and that, too, on spots where it would not be possible to grow coffee profitably. A tea may be produced inferior in quality to that grown on other plantations, yet from local circumstances in its favour, it may give a profitable return to the proprietor. It remains to be seen how far the advantages we possess in cheapness of transport and certainty of labour, will help to counterbalance the undeniable gain to Assam of great richness of soil.

Tea growers must not, however, forget that there is much more necessity in the production of a good marketable article, than the mere cultivation of the leaf. Much depends on its manipulation, both in the first stage of firing and rolling, and in the after preparation of the leaf for packing. There are tea plantations in the close vicinity of Nuwera Elliya and the Wilson Plains, at an altitude of 6,000 feet, and in a comparatively dry climate : there is another on the north-west face of the Rambodde Pass, at an altitude probably of 5,500, but with abundance of moisture : there are estates again in Upper Hewahetta as high as 4,000 and 5,000 feet, but with a north-easterly aspect : there are tea plantations in Lindula, in Ambegamua, Dolosbagie, Yacdessa, and Rakwane, ranging between 2,000 and 3,500 feet, and there are again estates of tea on the Avissawella and Peak ranges not more than 500 feet above sea level. It has yet to be seen how it will fare with all of these in yield, in flavor, and in durability. But all will equally need the care and skill of an experienced manipulator.—*Ceylon Times*.

INDIAN TEA-MAKING, &c.

To the Editor of the Produce Markets' Review.

SIR,—The usual custom of plucking in carefully-managed gardens is as follows :—The flush, for the two first flushes, is allowed to run to five leaves, of which only three are taken with the stalk, at one pluck. A portion of the fourth leaf is also sometimes gathered at the same pluck, but this bit of a leaf is often taken separately, at a second pluck, or move, of the hand. The piece of the leaf that remains on the bush is left to nurse the succeeding flush. The fifth leaf is left on to nurse the tree, for the sap does not perceptibly circulate in the leaves of the preceding year, and some portion of refined sap must return downwards to form new wood. By circulating through the leaves, the nature of the sap is altered. If every leaf were taken off, the new wood would become spongy and porous, and the tree in a few years would languish and look old. The old sap melts and returns ; the new sap rises by the action of the sun through the outer bark. In the root it appears to be only weak sugar and water , as it rises, it evaporates and becomes thicker, till it reaches the bud, which it occasions to grow.

The half leaf alluded to above having been separated from the stalk, will not easily roll, and often will not colour black (because it is separated from the stalk), and is called by us planters red leaf or fannings, while if it colours black it is called Broken tea. The twig with the three leaves on and the broken leaf are rolled together ; the different qualities, Pekoe, Pekoe Souchong, Souchong, and Broken Tea, are separated afterwards by sieving. When the leaf is put over the fire to dry it is red, the same colour as after infusion, but as it becomes dry it assumes a black hue. To colour the leaf black (in drying) it must be rolled with the stalk. Not so with green tea . then the leaf ought to be separated from the stalk, and the stalk must not be rolled with the leaf, or it will bruise it, make it red, and then it would dry black and not green. Respecting the third, fourth, and fifth flushes or harvests, the flush is only let run to four leaves, of which three-and-a-half are taken as above. There are many pluckings, three to each harvest—the early, the middle (the heaviest crop), and the latter shoots. The stalks in China tea are for the most part winter prunings, added afterwards : they are known by the clean cut of the knife, and their hardness. The true stalk of the flush is very, very, delicate, or the small delicate women and children of India, with hands more delicate than any of our women, could not pluck it. Bear in mind that it is plucked, not picked ; that is, it is seized or held between the soft parts of the first finger and thumb, and if not delicate and soft, would not come away, indeed, does not do so, if the harvest is a few days too old. The harvest is often gathered in torrents of rain, which men in this country would refuse to work in.

Pekoe in Chinese is "hairy leaf," and is the top bud. There are four to five harvests in the year, but every harvest does not give a hairy bud at the top of the twig. The first flush rarely gives it, as there is too much sun, which opens the bud too quickly ; nor do old trees always give it. In our English nomenclature, Pekoe means the top bud and the top leaf ; Pekoe Souchong, the leaf between the Pekoe and Souchong, the second on the stalk ; in fact, it means neither Pekoe nor Souchong. (Carefully sieved leaf ought to have no Pekoe tips.) Souchong means the third leaf on the stalk. If the Pekoe has few flowery tips, it is absurd to expect to see any in the Pekoe Souchong. To have flowery Pekoe, we must have a suitable season for it—sun, mist, and rain, in equal proportions. The red liquor of all black tea is made by brusing the leaf in the act of rolling (just the same as an apple, when bruised, turns red inside, although the skin is not broken), and the act of getting or becoming dry, no matter how, occasions it to assume a black look. If the leaf is rolled too hard, the juices run out, and quickly lose their flavour, become sour, just as the juice of an apple becomes cider. In the act of rolling, the red juices of the leaf roll over the white silver tips, and this makes the tips red, called Orange Pekoe, and the leaf at the side dries black. Orange Pekoe shows that the tea has been rolled properly. Flowery Pekoe means bright silvery tips, neither flower nor blossom.

A PLANTER.

Cheltenham, October 17th, 1878.

THE INDIAN TEA INDUSTRY.

THE cultivation of tea in in the British dominions is becoming a rapidly extending industry. Two small parcels of Ceylon tea were sold at the public sales this week in London, and realised a fairly satisfactory price. For a first effort the result was hopeful, although it is said there is much room for improvement in the quality. Whether tea cultivation will ever rival that of coffee in Ceylon, it is impossible to predict, as the industry is quite in its infancy. Capital, however is being raised, and we believe that a Ceylon Tea Company is being established with every prospect of success, although possibly in these times of dear money and general depression, the most favourable moment may not have been chosen for the launching of the Company.

The progress made by Indian tea is remarkable. It is becoming largely used in England, and it promises to be in future a serious rival to the Chinese productions. In 1873 only 18½ millions of pounds weight were imported into Great Britain from India, against nearly 32 millions in 1877. At the Paris Exhibition Indian tea, especially under the auspices of Mr. Burrell, has taken high honours, and it was judged superior to the Chinese teas. Mr. Burrell has been very successful in making Indian tea known in Europe. The gardens of Assam, Cachar, Chittagong, and the Neilgherries, and a number of other districts, are becoming celebrated throughout the world for their productions. No doubt the industry has suffered variations of fortune since its commencement, and its very existence has been threatened by the inexperience and want of knowledge of those who so eagerly went into the enterprise, and made haste to be rich with the proverbial result. As Colonel Money points out in the prize essay,—which we are glad to see has reached a third edition, for it is full of practical information, and deserves to be studied by every tea-planter,—a number of people of various occupations engaged in tea cultivation, for which they were not suited, and naturally failed to do any good. Tea cultivation, like everything else, requires special knowledge and experience. A proper amount of labour is essential, and this is now being obtained by the Assam tea planters from different parts of India. Considerable difficulty was also found in the Government regulations for the sale of waste lands. The Government might have been expected to give a more active and practical support to such a promising industry as tea. Other industries have probably been favoured with direct, or perhaps equally valuable indirect encouragement, and it is sufficiently recognised as a general principle by the Indian Government that the resources of the country should be developed, or at least that the first attempts at development should be made, with the assistance of the Government. Tea cultivation is of course now able to stand on its own merits, although a liberal basis might very well be admitted for the granting or leasing of Crown lands, and the Government ought to be sure of its own title to the lands it sell before putting them up to auction. For capital to be expended, security of tenure is required, and Colonel Money seems to think that this essential for an extensive and successful industry is not satisfactorily provided for under the present arrangements. The Government have also caused dissatisfaction by their stringent regulations regarding coolie labour. Each coolie brought to the tea gardens costs Rs. 30 ; and there are the expenses of housing the people, and supporting them when they cannot work ; and if the cooly dies, the planter loses of course the whole of the money expended in obtaining his services. This labour difficulty is one that will cure itself in time, for, with all the dense population of India to draw upon, a sufficent emigration could surely be secured that would satisfy the needs of the tea districts. The sugar planter in the West Indies has to spend at least £20 for each labourer he obtains from India, and to take all the risks besides of a long sea voyage, and of mortality among the people. In comparison with these conditions, the Assam tea planter enjoys facilities for obtaining labour which may be said to be perfect in

their way. He is, however, bound to produce as cheaply as he can. There is not a practically unlimited demand for tea. With a consumption that is not capable of an unlimited expansion, the hope of the Indian tea-grower must be in a successful competition with the Chinese producer, and this can only be brought about by sending to market tea of equal excellence, with that from China, but produced at such a cost as to allow a greater margin between profit and loss. That the struggle as to relative cheapness of production is becoming keener, the failure of the Japanese tea-growers to successfully compete against other sources of production is decisive proof. Goodness of soil, fully utilized by proper agriculture, thoroughly appropriate climatic conditions, plenty of labour and economy in using it, careful attention to quality and taste, and advantage of transport,—these are the mainsprings, both natural and artificial, of the Indian tea industry, and we may hope to see the tea gardens of India increase and multiply until the industry becomes sufficiently important to be reckoned as one great factor in the prosperity of India, and one unfailing security against that evil of national bankruptcy which it is the gloomy fashion of pessimist writers on Indian affairs so confidently to predict.—*Planters Gazette*.

COFFEE.

A CORRESPONDENT has sent a Ceylon contemporary a Liberian coffee leaf measuring 15 inches by 7 inches—probably one of the largest specimens ever seen.

The Mysore Planters' Association has applied to the local Government for the loan of the services of Mr. Harman, of the Experimental Farm, for a few weeks, that he may be able to give his opinion on that much vexed question—Coffee leaf disease.

SULPHUR AS A REMEDY FOR LEAF DISEASE.

A CORRESPONDENT, whose opinions are entitled to great weight, Mr. Morris, of the Royal Botanic Gardens, Peradeniya, Ceylon, writes :—

As there is now some indication of a trial being given to sulphur as a means of checking leaf disease, it may be of use to planters to have their attention drawn, through the columns of the *Observer*, to the "extracts and correspondence relating to the process of sulphuring diseased plants" which form the appendix to the accompanying report.

Sulphur seems everywhere the recognised specific for fungoid pests, now that (thanks to the labours of the scientists who have lately been so soundly abused) it is pretty well established that the *Hemileia vastatrix* in one stage of its existence, at least, is superficial, it is therefore within reach of such treatment as that applied to the *mildew* of hops and the *oidium* of the vine. If a serious attempt is made in Ceylon or a large scale, and extending over two or three seasons there is no doubt something satisfactory will be obtained.

I was reminded to-day by Dr. Thwaites of a astrong proof of the efficacy of sulphur in checking fungoid attacks in the case of the potato disease. This disease is caused by a fungus (*Peronospora infestans*) which like the *Hemileia* during one stage of its existence has a superficial development, that is, it is found on the stem and leaves of the potatoes before it penetrates the intercellular tissue and gives rise to fruit spores. Now in the neighbourhood of Swansea, where the air is charged with sulphurous fumes from the large copper works of that district, the potato disease is hardly known, and I have often noticed that the potato was the only vegetable which could be successfully grown within a certain area there.

If sulphur were applied in May, during the rainy weather, and carefully dusted over the stem, branches, and leaves of the coffee trees it is quite possible it might check the severity of the attack which comes on in June, July, and August. Again, say in September and October, when the fungus has fruited and the spores are lying in thousands on the ground ready to germinate and cover everything with their thread-like filaments, a good sprinkling of sulphur on the fallen leaves and everywhere round, might destroy the spores and prevent the filaments from again reaching the trees. These seem to be the best seasons for operating ; but even now it is not too late to apply sulphur to the stem and branches and thus kill the filaments that are probably luxuriating there under the influence of the present moist atmosphere. It is quite a mistake to think that because there are no fruit spores, there is no leaf disease. A microscopic examination of the branches, and leaves would, in April and May or almost at any time in the year before the spores appear, reveal such a development of mycelium or thread-like filaments of the *Hemileia* as would convince the most sceptical of its existence.

By all means give sulphur a fair trial—nothing promises a more satisfactory result if thoroughly and systematically applied.

The passages in the appendix to Mr. Cooke's report, sent to us by Mr. Morris, are as follows :—

Extracts and Correspondence relating to the process of sulphuring diseased plants.

"Wherever white fungi appear, at least where the fruit is superficial, sulphur may be applied with great advantage. As regards the peach mildew, practice had taught its value long before the grape mildew was thought of, and it will be found equally efficacious in the case of strawberries and other plants which suffer from similar attacks." *M. J. Berkely in Gardener's Chronicle, 1856, page 502.*

In practice it is found that the easiest, most economical, and at the same time the most effectual mode of applying the sulphur is by a common dredging box at the end of a long pole. Little at present has been done with solutions, but we should strongly recommend trial of Grigson's mixture especially in the later stages of the disease, as more speedy in its action. In all cases, however, the grand point is to watch the first indication of the mould, and apply the remedy at once.—*Gardener's Chronicle 1854, page 595.*

The composition of Grigson's mixture, recommended in the case of the vine disease, was the following : One pound of flower of sulphur, and an equal volume of fresh slaked lime, to be boiled for ten minutes in an iron pot in five pints of water, so as to give four pints of clear solution. This is to be mixed with one hundred parts of water, or to such other strength as may be found most efficacious, and applied with an engine.—*Gardener's Chronicle 1854, page 595.* [We should think that the mixture of lime and sulphur dusted on to the trees before or during rain would answer the same purpose.—*Ed., C. O.*]

In reply to applications to hop-growers in Kent for information as to the process in practical use amongst them, the following has been received ; "In answer to your question as to the use of sulphur for the cure of mildew in hop plants, I beg to inform you that 'flowers of sulphur' are usually employed for this purpose, which are the best sublimated sulphur. Some hop-planters, however, prefer *sulphur vivum*, or black sulphur 'soufre crut, which is, I believe, crude sulphur melted, allowed to cool after stones and other foreign substances have been disengaged, and then broken up. This is used largely in France in the vineyards against the *oidium*, it is heavier than the flower of sulphur and there is therefore, more difficulty in it application.

Sulphur is put on in hop-gardens at the rate of from 40 to 80 lbs. per acre there being about 1,100 hop-plants to an acre on an average ; with a sort of travelling winnowing machine, with a swiftly revolving fan, which blows the sulphur over the plants, as it is drawn between the rows by one horse. The rows of plants are arranged with regularity at distances of from 6 feet to 6 feet 6 inches apart, so that the sulphurator travels easily between them, being about 2 feet 8 inches in width. Their height is from 11 to 18 feet, so that the sulphurator, whose blast or pan from which the sulphur is expelled is about 3½ feet from the ground, covers the greater part of their bine and leaf surface with the fine dust.

The operation should be performed at night when the dew is falling, or after rain, that the dust may adhere to the plant, it is done twice, or even three times, but care must be taken not to apply sulphur after the flowering of the plant. As coffee plants are not higher than from 6 to 10 feet, and as I imagine not planted in regular rows, a dredge, and by hand, would probably be the best machine to use for putting on the sulphur. There are small hand machines with fans, as used in green-houses, that might be made, available.

May I be permitted to refer you to a paper upon Hop Cultivation, written by me in the sixth volume, second series, of the Journal of the Royal Agricultural Society of England, which fully describes the process of sulphuring."—*Charles Whitehead, Maidstone, Kent.*

As one of the oldest planters I have used sulphur for the cure of mildew, or as it is generally called mould by hop-planters, for many years. At first *sulphur vivum*, or refuse sulphur being cheaper, was used, and I believe I was the first planter who used the flowers or finest sulphur, which has been found the best, as it adheres more closely to the plant, and I believe is as cheap, from there being less waste. It is not used till the hop is in burr or blossom, or till white spots are seen on the leaves, though many planters almost always use it for precaution. The plant should have moisture on it to make the sulphur adhere, when it requires less. It is of little use applying it in dry hot weather, and thus, used will sometimes blister, and it requires some knowledge when and how much to apply. It is applied by an instrument drawn by a horse, which throws the sulphur over the plant, and as the coffee plant does not grow so high as the hop, and is planted as regularly, that may be easily done. One caution may be necessary. Hop-planters seldom use sulphur when the aphides or lice are found on the hops, as from a cause unknown the plant generally goes into what is termed a black blight.—*F. B. Eloy, Maidstone.*

In reply to yours received yesterday respecting the use of sulphur on growing hops. The way of using it is to put it on dry, not as a solution. Flowers of sulphur is used, and sometimes *sulphur vivum*, or black sulphur but the former would be the better for vines, and I should think for the coffee plant, but I know nothing of the habit of the latter. For hops we have a machine to throw it over the tops of the hops, and generally find it effectual.—*George White, Maidstone.*

In reply to your letter I beg to give you the following information regarding the application of sulphur to hop bines. The preparation of sulphur, which I prefer is the flowers of sulphur, but some hop-growers use a preparation called *sulphur vivum*, which costs less per ton, but which I believe is as dear in the end, and of less power as regards the mildew. My sulphur is applied either early in the morning when there is dew, or else on a still evening, but some hop-growers apply it in the day-time, when the sun is shining, which I consider leads to a very great waste, as when the hop leaves are dry, such a small proportion of the sulphur adheres to them. The sulphur is blown from a machine which is drawn by a horse up and

down the hop alleys. These machines I doubt whether they would be applicable to a coffee plantation, as I apprehend the coffee plant does not grow any height compared with the hop bine, and probably is not planted in rows six feet apart as the hop hills are. There is a hand machine which has been made for me which would be more likely to answer for use in a coffee plantation than the horsemachine, but failing this, a dredge for dusting by hand might be used. I apprehend the coffee planters do not labour under the same difficulty as the hop-growers as regards insects. Often hop-growers in trying to save their crop from being destroyed by mildew are drawn into as bad an evil, for if there are only a few aphides on the leaves, the use of sulphur leads to so great an increase of them as materially to injure both crop and quality. It seems extraordinary that this should be the case, but numbers of hop-growers can bear me out in what I say. I know of no one who uses a solution of sulphur.—*E. J. Goodwin, Wateringbury.*

At the very outset, Mr. Berkeley suggested sulphur as a remedy for leaf disease. Mr. Cooke, however, the other great authority on fungi, in the body of the report from which we have extracted the appendix on sulphuring, while strongly recommending sulphur as a remedy for another fungus, the "black rot" of Mysore, expresses doubts of its efficacy in the case of *Hemileia vastatrix*, thus :—

The means to be adopted for getting rid of a pest of this nature must necessarily be simultaneous on the part of all the planters, or it will only be temporarily banished from one estate, to be soon revived by the transportation of the minute spores through the air from estates on which the parasite may be permitted to flourish. There are features in the character and mode of action of this fungus which leads to the belief that the application of sulphur would have the same beneficial influence that it now has in the hop-gardens in checking the hop disease. When sulphur was first proposed for the hop it was with difficulty that the planters could be prevailed upon to adopt it. The opposition which the practice encountered was strong at the time, but experience having proved its undoubted value, it is now universally adopted. Although it is improbable that sulphur would be of any use against an endophyte like the coffee leaf disease (*Hemileia*), the "rot" is very different, and would submit to a different treatment. There is no doubt that every diseased leaf picked from a plant and burnt, diminished the" sources of future injury by so many depôts of undisseminated spores.

Again :—

Various opinions are expressed in the reports as to causes and treatment of the disease, on which it is difficult to form an opinion, and unnecessary to offer comment, further than to call attention to the fact that faulty drainage, stagnant water, and partly decomposed vegetable matter in the soil, are all favourable to the development of fungi, and determined to the healthy condition of the plants. It is doubtful whether sufficient precaution is always taken, either at home or abroad, that the soil about the roots of growing plants should not be contaminated by the mycelium or "spawn" of fungi, which is always to be found amongst partially decayed vegetable debris.

The specimen of soil sent with the leaves now examined is largely impregnated with mycelioid filaments. The partly decomposed fragments of twigs are so many centres from which the mycelium radiates in all directions. The appearance of the soil seems to indicate such an amount of stagnant moisture as would foster "root fungi," and prove detrimental to the growth of healthy and vigorous plants. Although some of this soil has been placed under experimental conditions, with the view of obtaining more certain and definite data, the result could not be ascertained so soon as would be required for this report. If any fact of importance should be evolved, it will be made the subject of a supplementary memorandum.

Fungi of the character of the *Hemileia* are not likely to be beneficially affected by the application of sulphur. Picking the leaves as soon as the fungus makes its appearance, and burning them, may, if perseveringly pursued, be of service. In Mr. M. D. Meppen's reply (see "Tabular Statement," page 11,) he states that : "last year he stopped its progress in a small field of young coffee by picking off the affected leaves. As soon as he observed the disease amongst the plants, he put in children to pick off all the affected leaves, which were collected in baskets and afterwards burnt. This stopped the disease on that field, as it did not appear again ; the young plants soon recovered, and became in fine condition." This is however, a tedious process, and not so easily accomplished when the trees acquire a larger size.

LIBERIAN COFFEE.

(Proceedings of the Madras Agri-Horticultural Society.)

READ letter from Deputy Surgeon-General Shortt, dated the "Retreat, Ercaud, 30th September 1878, forwarding the following report on his Liberian Coffee plants, and asking for a few plants of Pithecolobium saman.

"LIBERIAN COFFEE.—I received two plants from the Agri-Horticultural Society, Madras. These were sent to me from Bangalore, through Colonel Benson, and arrived here on the 21st October 1875. They were about 6 inches in height, looked sick and lanky, one having four and the other two leaves. They were planted out on the slope of a hill-side a little over 4,000 feet above sea-level, with a north eastern aspect under the chequered shade from some jungle trees in the vicinity : and in the midst of othe coffee which are 6 to 8 feet apart. A note was made monthly of their progress. But as there was not much to record during several months of the year, I will only here notice such months in which any preceptible change was observable.

"The plants continued stationary, and on the 6th December of the same year, No. 2 put out two fresh leaves. In February 1876 both plants looked dull, and during the following months of March and April were attacked with the leaf disease. In May No. 1 died down to the level of the soil, whilst No. 2 continued sick with shrunken and decaying leaves. In June No. 1 threw a new shoot from the root-end below the soil, and No. 2 put out fresh foliage, and improved materially in appearance.

In July No. 1, that had thrown up a new shoot died away completely, whilst No. 2 was looking vigorous and healthy and had attained 15 inches in height at the end of August, although infested with the coffee bug, whilst the common coffee was free.

"In April 1877 this plant had attained two feet in height, but was looking sick with most of the leaves more or less corroded. It continued much in this state with little or no improvement till July, when it began to recover its health and had put on a strong and vigorous appearance. In the month of October, though looking healthy, the plant continued stationary, and in January 1878, it continued much in the same state. It stood the subsequent dry weather very well and it now stands 40 inches in height and has four primary branches, averaging between 7 and 8½ inches each in length, the first pair is given off at 22 inches from the soil, most of the leaves are imperfect having corroded away, but the remnant left is green and healthy. At the summit of the plant as well as at the end of the branches, a fresh pair of leaves have formed in each, the largest perfect leaf measures 8½ by 4½ inches. This plant is now a little above three years' old, on the 21st of next month it will be three years since it arrived here, and perhaps when it came up it was between two and three months old.

"I have given the plant no special care beyond that of keeping it free of weeds, and in June last it got two baskets of manure (equal parts of cattle manure and rotted vegetable matter).

"A few months ago I received three other young plants from the Society. These were immediately on receipt transferred to larger pots, and after a couple of months were planted out in the open in somewhat rocky soil, with a southern aspect at the same height ; after a while two of the plants withered away, and the third is now shooting up."

Resolved, that Deputy Surgeon-General Shortt be thanked for the report, and informed that this Committee will be glad to have further reports on the subject, and hopes that he will soon have better progress to communicate.

COFFEE PROSPECTS IN TRAVANCORE.

IT seems pretty certain that the present season in Travancore will be a very poor one, worse, if possible, than either of the two preceding years. The hopes raised at the beginning of the year by the good blossoming have been falsified by the subsequent failure of the berries. The crop has dropped in an immature condition from the trees and not more than a fifth or a fourth of the estimated crops will be forthcoming. On some estates the outturn will not exceed three bushels to the acre, and certainly very few plantations, if any, will pay expenses. This discouraging outlook is all the more distressing that it follows two very poor years already. Many a small capitalist has hoped on and tided on in the sanguine expectation of "pulling it off" this year, whereas all such planters will now be in a worse state than ever. The multitudinous small native planters who have sprung up from nothing like mushrooms, will collapse like mushrooms, and their estates heavily mortgaged, will not, in the present state of things, fetch the money advanced upon them. These men are turning hopelessly in all directions for the means of paying off their old debts and of carrying on their coffee works.

The South India Coffee Company are also feeling the gloomy outlook very severely. Not only do their own estates cost more than they produce, but the heavy advances to others have drained the coffers most unmercifully. The Company find that, in anticipation of a better crop than will actually be realised, they have allowed their clients to overdraw the value of the now estimated outturn. Consequently, they have been obliged, in self-defence, to put the screw on pretty tight, and to demand the repayment, at once, of the overdrawn amount. When the only hope of payment at all lies in the crops, and when the crops themselves are overdrawn, it is not easy to comply with the Company's demand on any terms whatever.

There is no ground for despairing of the ultimate and even proximate success of the Travancore coffee enterprise. The abnormal seasons of the last three years have thrown the coffee, root and branch, into an abnormal condition. The trees miscarry of their fruit by reason of the weakening influences of the past few years. They want tone, and this, we trust, they will soon get. The cycle of drought should have exhausted itself in the present season, and 1879 ought to inaugurate a cycle of bumper crops such as were seen seven or eight years ago, when within three years of planting the Rova estate paid all its previous expenses by its maiden crop, and left a substantial profit in addition. The comparatively low elevation of the Travancore estates is the cause of their ruinous failure when the rainfall is less than usual. This defect cannot be remedied except by the abandonment of the low coffee altogether, and this probably will yet have to be done. There is one ray of hope, though a heavy feeble ray, in the thought that a short crop may fetch higher prices through sheer scarcity of the article. We have not at present sufficient information with regard to this year's coffee produce of other countries to enable us to gain any solid comfort in this direction.

The heavily handicapped condition of the coffee enterprise in Travancore, to which we have referred on previous occasions, is now felt to be a very serious burden indeed. Land tax and export duty have to be paid on the produce of land which would not fetch its original purchase-money if put up to auction to-day. It would be an act of grace to remit the land-tax on all coffee land purchased within the last seven years, on land, that is, that has hitherto been nothing but an expense and a loss to its owner. The Government would lose something certainly, but this will happen in any case after such a year as the present. Those sanguine but impecunious individuals who "went into coffee" on borrowed capital and have been borrowing ever since will have learnt a wholesome lesson; while hopeful capitalists will buy up no end of coffee estates for a mere song. It's ill wind that blows nobody any good.—*Madras Times.*

SULPHUR AND BURNT LIME AS REMEDIES FOR LEAF FUNGUS.

On the effects of sulphur we have the following testimony from a planter of so much experience as Mr. James Blackett:—

Dotel-Oya Estate, Aranayka, 5th November 1878.

Dear Sir,—In your issue of last Saturday, you court enquiry on he application of sulphur, under the heading of "Cure for Leaf Disease."

The following is at your service. In November 1875, I applied 5 *cwts.* of sulphur to a little more than five acres of coffee, or at the rate of an ounce to a tree (patches of which had several severe attacks of leaf disease) mixed with artificial manures, spread evenly over the surface and thoroughly dug in to the depth of 8 to 12 inches with one-pronged diggers, and for the first year or two I could see no abatement of the fungus as the seasons came round; but during the last twelve months I could see an improvement, not very great, but a decided check, and I am now of opinion that the action of sulphur is slow and that it should be applied in larger quantities. I intend trying two ounces to a tree very soon.

There are a good many things to be taken into consideration with regard to the coffee, I have tried the sulphur on, such as the crops it gave before leaf disease was known and since then, and the treatment it had before and after, and present appearances with a crop of at least 8 *cwts.* an acre this season, all of which I have made fair allowance for in my own mind before forming an opinion as to the efficiency of sulphur; but I am apt to err like most mortals.—Yours faithfully,

Jas. Blackett.

Sulphur must be applied in much larger quantity than about 80 lbs. to an acre, before immediate and marked effect can be produced. Mr. Blackett's experience seems hopeful, however. Probably mixing the sulphur with acid or ammonia calculated to make it immediately soluble would be advisable. Good cow-dung would probably be a good vehicle.

We have several times adverted to the beneficial effects of lime, our latest reference being to the case of a planter who has found the application of burnt coral to some of his land followed by such excellent effect that he is determined to treat all his land after the same fashion. But even more than in the case of sulphur liberal applications of lime are necessary, and in the absence of railway extension the cost is in many cases prohibitory. Of the value of lime, however, there can be no question. Some of our readers may recollect a paper on the "Soil of Old West India Sugar Estates," by Professor Phipson, which we extracted into the *Observer* and commented on. Dr. Phipson traced much of the infertility of the exhausted soil to the absence of lime. That burnt lime applied to sugar land is followed with the best possible effect we have had fresh proof, in the account a Ceylon sugar-planter has favoured us with a visit to sugar estates in Penang. The estates were formed on mangrove swamps which were bunded and sluiced with reference to a rise and fall of tide, equal to 6 feet. Drains or rather canals were cut through the land so as to give facilities of water carriage. From our friend's description, we were reminded of all we have read of the sugar estates in Sir James Longden's former scene of Government, Demerara. After a time the canes on this land were affected by insects (*pou blanc*) and red rust, much to the diminution of the returns in sugar. But vast masses of comminuted shells were close at hand which Chinese were employed to burn. By means of the facilities of water conveyance, the estate was thoroughly limed, and all evil effects disappeared. It is true that specimens of the insects may still be found when sought for on the canes, ready, no doubt, to multiply and do mischief should the lime be used up. But there is no red rust and no diminution of the fair average yield of sugar. We are strongly inclined to believe that, were it possible to lime a coffee estate at the rate of 5 tons per acre, it would suffer little, if at all, from the effects of fungi, or grubs, or white bugs.

EXPERIMENTS IN COFFEE CULTURE.

In the Ceylon Legislative Council on November 20.—The Hon. G. A. Talbot, in introducing a motion "That the different species of coffee grown in the West Indies be imported and grown in the Royal Botanical Gardens of Ceylon," remarked that they all felt indebted to the Governor of Trinidad for the information as to the coffee grown there, which he had sent here. If those species could be developed and grown here it would be the means of increasing our large industry—the planting industry. There was a great deal of uncultivated land at nearly every elevation and with a great many different sorts of soil, but lately an impression had gone abroad that all the land available for coffee has been filled and that there is no more jungle which could be planted with coffee, and therefore a great deal of capital which would otherwise have come here, had been diverted. It was more than probable that if those different species could be introduced to the Botanical Gardens a great deal of land which cannot now be used might be planted with coffee. He therefore moved that those species be introduced to the Botanical Gardens at Peradeniya.

The Hon. J. P. Obeyesekera had much pleasure in seconding the motion made by the Hon. Member for the planters, especially as there was every probability that several species of coffee may be discovered in the West Indies that would be suitable for the lower elevations at the maritime districts of Ceylon. The fact that the Liberian coffee grows well at a low elevation afforded him every reason to suppose that fresh varieties can be obtained from the West Indies that will be equally suitable for the low lands here.

His Excellency said that there was only one point on which he would ask the Hon. Member (Mr. Talbot) to make an alteration, and that was to introduce the words "and Surinam, Dutch Guiana and Berbice." The English Colony of British Guiana was a very large coffee exporting colony at one time, but the coffee plantations were rooted up to give way to sugar plantations, which were more profitable, although the coffee was a very fair quality indeed. The coffee land there lay at water level, or even in some places below the sea level; there were not any high hills there.

The Hon. Mr. Talbot said he and in fact every one interested in Ceylon was very much obliged to His Excellency for the information which he had given them. He, therefore, inserted the words suggested into the motion.

The Colonial Secretary observed that the Government would have the greatest pleasure in complying with the motion of the Hon. Member

The Hon. Sir Coomara Swamy suggested that the words "Botanical Gardens" should be omitted and that "Ceylon" should be inserted in their place, as it might be found that the coffee would be found to grow better in other places than the Botanical Gardens.

THE INSECT REMEDY FOR LEAF DISEASE.

Sir,—In a recent visit to some estates in the lower coffee districts, I examined as many fungus-diseased leaves as I could, whilst walking through the various estates, and shall be very pleased to hear from others, that my experience was not an isolated one.

In Kadugannawa, on about one-third of the leaves examined, I failed to find any insect preying on the fungus, but on the remainder, there were as many larvæ feeding as would average 5 or 6 to a leaf; on several leaves there were 9 or 10, and on one as many as 26. In west Matale my experience was the same, only there the number on one leaf was as high as 34.

All the estates I refer to adjoined native jungle and chena,

The larvæ were all lively, and on most of the leaves had entirely eaten away many of the patches of fungus, leaving only round marks like stains.

I believe the larva to be that of a minute fly, as I saw several of the latter walking about on the fungus spots, apparently laying eggs; the fly is, I think, identical with one I noticed some years ago infesting the wild fig tree in the low-country, on opening the fruit of which I have seen hundreds if not thousands emerge from their prison.

If others in the low-country can corroborate my experience, I think we may have great hope that in the insect world we shall find at least one of our best allies for overcoming *Hemileia vastatrix*.

F. M. MACKWOOD.

Colombo, 16th Nov. 1878.

PORTER AS A CURE FOR LEAF DISEASE.

W. A. M. D. writes to a Ceylon contemporary:—"Referring to your paragraph, "cure for leaf disease," in the *Observer* of November the 2nd and the mention therein of the use of country rum in the preparation recommended by the correspondent to the *Gazeta de Noticias*, Rio de Janeiro, has re-called to my mind a fact which I saw some years ago on a large estate in Dimbula. The field of coffee round the bungalow had a very bad attack of leaf disease, but another gentleman and myself remarked that a few trees near the bungalow markedly stood out as having hardly a diseased leaf. A close examination showed that the drippings and washing which pass a lot of beer and porter bottles, must have been the cause. We therefore, to try the experiment, applied two bottles of porter to six trees that were affected and found that these trees recovered in a wonderfully short time. Of course we thought nothing more of it as the little item of cost stood in the way.

CINCHONA.

A RESOLUTION on the annual reports on cinchona cultivation and on the Quinologist's report is published in a recent issue of the *Calcutta Gazette*. The cinchona plantation consists of two parts—the older portion at Rungbee, Rishap and Mungpoo, in the valley of the Runjo; and the newer on the Sittong spur, and in the adjoining valley of the Ryang. The working of the plantation during the year 1877-78 was, on the whole, very satisfactory. The Sittong plantation was increased by 152¼ acres, and the older plantation by 97¾ acres. The total area of the former is now 242 acres, and of the latter nearly 2,000 acres. The Sittong plantation is still too young to yield a crop, but the crop from the older portion was 344,225lbs. of dry bark. During the year under review 706,600 red bark trees (*Cinchona succirubra*) were planted out, namely, 26,800 in Rungbee and Rishap, to replace the old plants uprooted in taking the bark crop, and 679,800 on new land—265,800 on Mungpoo, and 414,000 on Sittong. In addition to the red barks, 8,870 trees of a hybrid variety were planted on the Sittong division; this variety yields an excellent bark and promises to be very valuable. Efforts have been made to increase the cultivation of the yellow bark tree (*C. calisaya*), which produces the most valuable of all the medicinal barks; but owing to the difficulty of propagating the best varieties by seed, progress has been slow. The result of the year's operations with these plants has been only to increase the stock in the nurseries by 2,000 plants. The question of selecting other localities, where the climatic conditions are more favourable for the propagation of this plant than in Sikkim, has been separately submitted by Dr. King, and is under the consideration of Government. The crop of the year consisted of 341,060lbs. of red bark, and 3,165lb of grey bark, or 344,225lbs. in all of dry bark, against 207,781lbs. in 1876-77 and 211,391lbs. in 1875-76. The bark yielded in former years, *i.e.*, from 1869-70 to 1876-77, amounted in the agrregate to 529,017lbs., so that there has been taken from these plantations since their commencement no less than 873,242lbs. of dry bark. The Red bark crop was taken by the three methods of harvesting usually followed, namely, up-rooting, coppicing, and thinning :—

	lbs.
Up-rooting	[illegible]
Coppicing	[illegible]
Thinning	97,274
Total	[illegible],060

Ninety-two and a half acres of trees planted at distances of six feet by six were up-rooted and 176,625lbs. bark thus obtained, being at the rate of 1,909lbs. per acre. The land on which these trees were grown was not well suited for cinchona cultivation, and the outturn given above does not include bark obtained in past years by thinning and pruning. The experience gained on the plantation is sufficient to show that complete coppicing, *viz.*, cutting close to the ground all but a few trees, is a perfectly safe way in Sikkim of taking the bark crop. Trees from four to six years of age coppice better than older trees, but the method of partial coppicing results in failure with trees of every age.

THE Government Cinchona Plantations in the Madras Presidency yielded in 1877-78 138,838½ lbs. dry bark, which is a large harvest of bark than had up to that time been taken in any one year. It was thus distributed :—

		lbs.	
Crown Bark ...	Natural ...	32,857½	
	Mossed ...	24,679½	
	Renewed ...	12,003½	
	Branch ...	5,855½	
			75,395½
Red Bark ...	Natural ...	17,076	
	Mossed ...	25,392	
	Renewed ...	18,183	
			60,651
Other Kinds ...	Yellow ...	1,845½	
	Grey ...	677	
	Dust and Mossed...	239	
			2,761½
		Total ...	138,808½

Of this crop, 132,951½lbs. were sent to England, 1,000lbs. were supplied to the Government of Bombay, and 4,330lbs. to the Madras Medical Stores. It is observed that no record has been kept of the number of trees that were stripped and mossed, but that information on this point will in future be available. The trees on the plantations having now been numbered, and subdivisions formed, some sort of working plan can be probably framed, and the yield in each sub-division be estimated with fair accuracy. The harvest in the previous year was 103,341lbs. of which 102,384lbs. having been sent to England were sold within the official year now reported on for £30,434-12-0. The Commissioner takes no credit for any receipts within the year from the 1877-78 crop, but of the £33,231-12-10 which it fetched £19, 965-10-0 were realized before the 31st March last.

The prices fetched by the shipments of Crown bark during 1877-78 were still high, though below those obtained for the previous year's crop, *viz.* :—

	Highest prices. 1876-77. Crop.		1877-78. Crop.	
	s.	*d.*	*s.*	*d.*
Natural	13	9	8	4
Mossed	15	8	8	5
Renewed	13	5	11	10
Branch	15	7	10	6

Red bark, with the exception of "renewed" red, had much declined in value, *viz.* :—

	Highest prices. 1876-77.		1877-78.	
	s.	*d.*	*s.*	*d.*
Natural	11	0	1	9
Renewed	9	2	5	10
Mossed	4	7	2	8

In view of so large a harvest of bark, the plantations may be taken to be in a satisfactory condition; but the Commissioner states that there is still a difficulty in regard to labor, and that this led to "very little manuring," being carried out at Neddivattum and Pykara. It appears from the expenditure statements that only Rs. 461-4-9 were spent under this head against an estimate of Rs. 700, and that of this amount, Rs. 400-5-6 were expended at Dodabetta, while the Neddivattum plantations received 15-10-6, and those at Pykara only, Rs. 9-4-6. The favourable results obtained by manuring have been frequently demonstrated and led to the late Acting Commissioner making a larger provision on this account in the current year's budget. Every effort must be made to utilise this provision to the full extent, for it is above all things necessary that the trees should not be "starved" now that their recuperative powers are so largely taxed by the repeated removal of bark.

Scarcity of labour appears to have been also the cause of only Rs. 13,025-2-1, out of an allotted sum of Rs. 25,279, being spent on upkeep, and the subject demands serious consideration. It seems probable that the Government rate of wage is too low, and if found to be below that offered by private planters, it must be promptly raised. If this is done there should be no difficulty in obtaining coolies at Dodabetta, nor yet at Neddivattum, now that good lines have been built and arrangements made for storing grain against the monsoon. From the Commissioner's remarks in paragraph 6, there would appear to have been a tendency to subordinate the work of cultivation to that harvesting. This, the Government observe, must be checked, lest the future of the plantations be sacrificed to present gain.

The propagation of young plants appears to have been vigorously prosecuted, and the Government notice with satisfaction that 5,000 were planted out in the Dodabetta plantations. The public took 187,350 plants against 142,000 in 1876-77, whilst the demand for seed rose from 143 ounces to no less than 323lbs. Cuttings to the number of 170,500 were also sent out of the nurseries. The stimulus afforded to private enterprise by the success of the Government plantations could receive no stronger proof. Adverting to the Commissioner's remarks regarding the results of the small coppicing experiment of May 1871, the Government observe, that Captain Walker states in his report that suckers were left growing when the trees were cut, and that it is impossible now, to distinguish these from " real coppice shoots from the stool."

In September last, Mr. Barlow applied to Government for permission to propagate the rarer varieties of cinchona, such as *calisaya* and hybrids, for sale to the public, and incidentally alluded to by the Cinchona Committee being in favour of more extended propagation of all the varieties. The Government sanction operations, on a moderate scale, for raising every variety for which there is a demand. Some indecision has lately marked their action in this respect. A proposal by Mr. Webster for an enlargement of the nurseries, with a view to meet fully, if possible, all demands was negatived, as it involved an extension of the plantations, and it was considered advisable to encourage the raisings of seedlings by private persons, but it was not intended to put a stop to operations within the limits already fixed. It is now ordered that the attention of the Assistant Superintendent at Neddivattum should be mainly turned to the propagation of the calisaya species, as well as of any other variety that his experience may lead him to consider adapted to the circumstances of the Wynaad plantations ; but as long as a demand for *C. succirubra* and *C. officianalis* plant exists, these also should be reared as far as space will allow.

We learn that Mr. Woolley has concluded, through Messrs. Parry and Co., of Madras, the purchase of Colonel Fyers' Cinchona Garden on the Koondahs. This property was originally acquired by the late Mr. Schnarre, and is said now to contain some fine cinchona trees. The bark on the plantation was once removed, and the trees seemed to have renewed without the application of moss. Perhaps this was the work of shade. The fact is one deserving of notice.—*South of India Observer.*

CINCHONA AND HYBRIDIZATION.

(*From the Ceylon Observer.*)

DRS. HOOKER and Thompson, great and leading botanical authorities, represented hybridization or the crossing of species to be one of the rarest possible occurrences in nature. And the operation is often difficult and often baffled when all the resources of the gardener's art are applied. We were therefore, not a little surprised at the tone taken up by botanists in India and Ceylon about hybrization in the case of cinchonas. Planters were warned against it as the source of untold evil. While the late Mr. McIvor was experimenting in the production of hybrids, so as to secure improved plants, Mr. Broughton denounced the vegetable half-castes, as partaking only of the bad qualities of both parents! This in the face of the fact that the bark of a hybrid produced by Mr. McIvor was pronounced by Mr. Howard to be one of the richest he had ever met with. Mr. Howard wrote an able paper on the subject, and shewed how liable *C. officinalis* and *C. calisaya* were to sport,—a dozen varieties, or as Mr. Howard preferred to call them, *forms* being obtained from the seed of a tree apparently of pure type. Mr. Broughton wrote to Mr. Howard truly, that from the pure stock plants of *C. officinalis* he (Howard) had sent to the Nilgiris every possible form, large-leaved and small, sharp-leaved and broad, would be seen growing on Dodabetta. The changes produced in *C. calisaya* by the climates of the Nilgiris and British Sikkim were attributed to processes of hybridization for which really there had not been time. It will be in the recollection of our readers that the bark of true *C. officinalis* from Lool Condera, for which Messrs. Howard and Whiffen paid such high prices, was pronounced to be that of *C. calisaya*, or of a cross between that variable species and the true-to-type *C. succirubra*. It thus appeared that good results from crossing were anticipated. Our own sentiments have been often stated. We treat the idea of hybridization as a mere bugbear, while we believe in almost interminable variety or difference of form as the results of seed from the same plant. And even when cuttings are taken there are wonderful diversities of form. If the cinchonas we cultivate are hybrids, then the crossing must have taken place in South America. This is what botanist Kuntze says, according to a review we extract from the *Planters' Gazette*, and he goes so far as to characterize the famous *C. ledgeriana* as a hybrid. He also talks of it as sterile at the very moment that seed from trees the produce of Ledger's seed, is being received in Ceylon from Java Herr Kuntze not only believes in the hybridization of the cinchonas, but evidently does not believe in the goodness of any which are true to type ! So do botanists differ to the confusion of poor non-scientists like ourselves. What *are* we to think or believe? One thing we certainly take leave to doubt, and that is that that *C. ledgeriana* as a hybrid was accidentally produced in India.—What we do believe is that seed of *C. ledgeriana* produced plants differing widely, in accordance with climate, in Java, in Sikkim, and in Southern India. We prefer to hold with Howard to immense variety of form, rather than to constant tendency to "mingle, mingle." But, as Mr. Kuntze believes in endless hybridization, we wish he had revealed the secret of that *irregular* process by which barks with 12 per cent. of quinine are invariably obtained. Some of our friends who are so afraid of hybrid *C. officinalis*, will be horrified to see that Kuntze classes this kind not as a species, but altogether a hybrid! The review is as follows .—

THE CINCHONAS CULTIVATED IN ASIA.

Any contribution to previous knowledge of cinchonas and their most profitable culture is welcome. We are not in a position, however, to judge of the value of a great deal contained in the pamphlet quoted below ; but if Mr. Kuntze's claims to the honour which he covets rest upon the merits of this work alone, or even combined with his primeval freshwater ocean, his chances should be very slender indeed. Nevertheless, we give the substance of it for the benefit of our friends in India, who may be able to corroborate or controvert the writer's views. From the title we expected a monograph of the whole genus, but found it to include only the forms cultivated in Asia. In the course of his travels Mr. Kuntze visited the plantation in Java and in India, and he states that he is the first botanist who has comparatively investigated the Dutch and English plantations since they have been in a flourishing condition ; consequently he is in a position to publish many hitherto unknown facts. With regard to the yield of alkaloid, he says, " It is no small result of my cinchona studies that I can confidently propose a plan whereby in future it will be possible to obtain an average of 12 per cent. instead of the 1—4 per cent hitherto obtained." This is to be effected by planting hybrid forms, as the secretion of quinine is increased by hybridity. "And the more irregular the hybrid—that is to say the less the characteristics of the parents are blended in the offspring, the richer the bark is in quinine. At present only one irregular hybrid is known, *C. ledgeriana*, which yields from 5—13½ per cent. The latter equals 17·83 per cent. of sulphate of quinine, the maximum quantity hitherto found. Unfortunately this hybrid is mostly sterile, whilst all the other hybrids are extraordinarily fertile."

An "irregular" hybrid is the offspring of a species fertilised by the pollen of a hybrid, in which the characters of the parents, instead of commingling and forming an intermediate in leaves, flowers, &c., are separate and easily recognised. The present method of planting practised by the Dutch is in rows on gentle slopes in forest clearings at an elevation of 5,000 feet to 5,500 feet. Treated thus, Kuntze states they succeed well, and this mode of treatment he regards as better than that adopted by the English in India. All the kinds succeed in Java, whereas in most other plantations only *C. succirubra* succeeds.

According to the official report of July, 1876, there were then in Java 2,012,187 cinchona trees, namely :—

1,001,670	C. Calisaya—Hasskarliana
565,336	C. Officianalis
223,200	C. Calisaya—Ledgeriana
177,493	C. Succirubra and caloptera
44,030	C. Lancifolia
512	C. Micrantha

The Dutch are letting *C. succirubra* and *C. mircranthu* die out, because their bark is very poor in quinine ; whilst the English have planted little else than the former, the bark of which is unsuitable for commerce, as it usually contains only 1 per cent. of quinine against 3 per cent. of cinchonine. The number of cinchona trees in India is estimated at 10,000,000 to 12,000,000. With regard to species, Mr. Kuntze could only distinguish four in the plantations of Java and India, three of which he "was obliged to re-name; because the names by which they are known in cultivation are partly defective, partly connected with faulty descriptions, and partly include species and allied hybrids." This proceeding is all the more indefensible as the author recognises the fact that hybridity in the genus is illimittable. His species he places in two groups, characterised as follows :—

A. Leaves small, dark green, ribbed almost coriaceous leaves, regular capsules, and funnel shaped fruit calyx.

1. C. Weddelliana, Kuntze ; C. Calisaya *pro parte.*
2. C. Pahudiana, Howard.

B. Leaves ample, light green ; thin capsule ventricose, beaked.

3. C. Howardiana, Kuntze ; C. succirubra, *pro parte.*
4. C. Pavoniana, Kuntze ; C. micrantha, *pro parte.*

C. lancifolia mutis, C. officinalis, L., C. scrobiculata, Hb. et Bpl., C. Purpurea, R. et P., and several others are regarded as hybrids of American birth. The *specierum hybridar umque clavis* is no doubt carefully elaborated, as the author has had some practice in "re-forming" the classification of Brambles ; but we fail to see the utility of it. In the first place it is admitted that the species freely hybridise, and the hybrids cross with each other and the species in the most indefinite manner. Secondly, will any one planter label a certain hybrid according to its pedigree as follows : "*C. Howardiani-Pahudiani cum Pahudiana denuo cum Pahudiana Weddelliana*"? Each succeeding generation of seedlings, if the off-spring of cross-fertilisation, which they most likely would be, would get an additional name. The hybrid C. Ledgeriana was orginally brought from America by Mr. Ledger, who found it 120 *leguas* from Pelechuco in Bolivia, and it has also been accidentally raised in India ; Kuntze recognises it as the offspring of the hybrid Pavoniani-Weddelliana fertilized with pollen from one of the original parents, and as it is sterile he proposes raising it artificially in the manner indicated. Respecting C. micrantha, the author says that the larger the blade of the leaf is, the shorter is the petiole ; but this is not in accordance with our experience.

Registered No. 182.

THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA: SATURDAY, 1st FEBRUARY, 1879. [No. 2.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

Calcutta, 1st Feb. 1876.

R. KNIGHT.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

CHEAP PLOUGHS.

SIR,—I learn from the Report of the Agri-Horticultural Society published in the *Agriculturist* of January, that wooden ploughs on the American pattern "can be made here (Calcutta) at from Rs. 12 to Rs. 15, whilst light English ploughs for a single horse or pony, cost from Rs. 45 to Rs. 50." Would you let me know whether Dr. S. Lynch could supply ploughs on the American pattern at Rs. 15? An authoritative reply would oblige your correspondent as well as several others in this district.

S. DATTA.

Bishwanath, Assam.

EUCALYPTI.

SIR,—I see a correspondent enquires whether Eucalypti have been known as yet to bear fertile fruit in India.

I presume the Eucalypti in the Neilgherries have been bearing seed for many years. As regards the Punjab, I can state that a tree planted by Mr. Perkins, C.S., in the garden of the Deputy Commissioner's house at Hoshiarpur, about 12 years ago, and now about 50 or 60 feet high, bears a small quantity of fertile seed. Also, that the Eucalypti planted at Abbottabad in Hazara district seeds freely, for I have had several pounds of seed sent me from that station. The growth of the Eucalyptus in Hazara is very rapid: and it is probably there that its greatest success in the Punjab has been attained.

The species are so difficult that I cannot be sure of the species either by the tree first mentioned, (there are now many of the same kind in the station and district of Hoshiarpur) or of the Hazara one. I think however the species in both cases is identical. It is *not Globulus. Globulus* does not readily succeed here. It is not *Rostrata*, which is easily identified by its long thin leaf, and willow-like stem in the young plant.

W. COLDSTREAM.

Hoshiarpur, 16th January, 1879.

EXPERIMENTS IN WET CULTIVATION.

SIR,—I have much pleasure in enclosing for your information and that of the subscribers to the *Indian Agriculturist*, a detailed statement of the results derived from deep ploughing on paddy lands, carried out during the years 1875-76 and 1877 by an enlightened native resident in the French settlement of Karikal in this district.

To ascertain the yield per acre deduced by these experiments, I would premise that the *veli* of land measures 6·6 acres, and inasmuch as 20 *mahs* go to one *veli*, one *mah* is as nearly as possible one-third of an acre.

The yield of paddy therefore per acre, it will be seen, was nearly 82 *kalams*. A *kalam* is equal to 24 Madras measures of paddy, or 12 Madras measures of rice weighing in the aggregate, say, 36lbs. So that the yield per acre amounted to 82×36lbs., or the respectable quantity of 2,956lbs., or nearly 30 bushels (taking *wheat* as the standard).

The ratio of yield on lands treated scientifically and non-scientifically is, it will be seen, as 5·4 to 1 in this instance of wet cultivation.

R. R. E. BROCKMAN,
Captain R. E.

Tanjore,
21st, December 1878.

IN Soopprayapooram, a village attached to Maganum of Tironnellacr, 3 miles from Karrical, I made the following experiments, induced to do so by the study of Mr. Robertson's reports.

Plot No. I.—It contains 230 gulies (2 mahs and 30 gulies) and is a sandy soil. During dry season no cracks are apparent on the surface.

Plot No. II.—Sandy on the surface, and no cracks during dry season; but the sub-soil is quite clayey. They call it *Ooki kilar*. Even during dry season, when the surface is firm, there were unsound clay places below in which cattle would sink to the knee. These they always avoided and would pass only when forced. It contains 580 gulies (5 mahs and 80 gulies).

Plot No. III.—Stiff clayey during dry season full of deep cracks containing a little more than 200 gulies or 2 mahs. When blocks of this stiff clay were turned, they contained plastic clay containing moisture, whereas on the surface and bottom it was dry earth.

In 1875 I bought an English plough called Howard's Combined Plough, and as it was in pieces nobody at Negapatam knew how to fit it together (though we could form some idea of it from seeing a figure of it in the Agricultural Class Book) till a Brother of the Society of Jesus, in St. Joseph's College set it all right very soon. I must say that this was one of the ploughs supplied by the Madras Government some years back and three Mirasdars bought it to please the taluq authorities, and it was never used by them, and was lying idle at Negapatam, where I managed to get it.

Soon after harvest in the middle of February 1875, and before the commencement of the dry season, the 3 plots were ploughed up to the depth of 6 inches by the said combined plough. Buffaloe bulls such as are used in drawing carts were yoked, and pulled the plough with ease. All the 3 plots were ploughed twice.

In plot No. I, twenty five cart-loads of ashes and street sweepings were applied towards the close of May or the beginning of June.

In plot No. II., twenty carts of the said manure and 40 carts of tank scourings (at 8 cart-loads for a rupee) were applied.

Plot No. III had no manure.

Plots Nos. I and II were grown with Arupatham Kuruvay paddy, and plot No. III with Segappu Sermmany paddy well suited for seasons of drought. Though the former paddy is called Arupatham Kuruvay (60 days Kuruvay) it actually takes almost 3 months for harvesting. It was sown in the month of June which is generally the commencement of cultivation season in that part of the country. As soon as water was let in, country ploughs were used for puddling, and within 3 days the plants were transplanted. The Kuruvay seedlings were from 18 to 22 days old. The Kuruvay plants were watered as country paddy plants.

Plot No. I gave (33) thirty-three kalams, of Kuruvay paddy and plot No. II gave (48) forty-eight kalams for the first crop. After Kuruvay harvest I applied 2 cart loads of Kivaley po udu in plot No. 1 only. This plant is used as manure in many villages about Karikal and grows in sandy soils near the coasts. I don't know if it is the wild indigo referred to by Mr. Robertson, I have not seen this plant in the interior. After cultivating with country ploughs I again raised Chumba paddy in plots Nos. I and II.

Plot No. I gave me (30) thirty kalams, and plot No. II gave (35) thirty-five kalams, and plot No. III gave (18) eighteen kalams and only one crop was raised on it.

Next year, which was one of general drought, plot No. 1 alone was grown with double crops as before. This year plot No. I had not a[illegible] manure. About only 5 carts of cowdung were applied and about 50 sheep were folded in the said plot for about 20 days, whose manure was ploughed in. The said plot No. I [illegible] double crops of Kuruvay and Chumba paddy, gave (60) sixty kalams. Plot No. II had no double crop as about the time of transplanting Kuruvay seedlings the irrigating channel was dry. Of course plot No. III had never double crops and it yielded very much the same as before [illegible], 18 kalams. This plot was too low and generally inundated. It is also situated amidst the fields of Kallundai paddy, which is suited for lands of low level and the plot was not manured. In this year (say) only which was one of general drought, the effect of deep ploughing was very striking.

For when the adjoining fields had suffered from Suley or Kulichombu my cultivation did not suffer. The deep ploughed soils retained moisture till water came in, while other lands not so ploughed, suffered.

In the 3rd year the same thing was done as in the year preceding and plot No. 1 of 2 mahs and 30 gulies never yielded less than 60 kalams for two crops and ranged from 60 to [illegible] kalams after paying the charges of reaping and threshing when as before the experiment the said plot scarcely yielded 10 kalams. The result of the other plots are also satisfactory in that, while the average produce of these plots as well as of similar plots in the village under the ordinary system, was about 100 kalams a veli, or 5 kalams; [illegible] the produce under this experimental system was more than [illegible] that quantity. I am sorry the exact quantity of produce under the old system for the same plots was not recorded before.

The inferences to be drawn from this are—

(1) The excellence of deep ploughing cannot be doubted for one moment. The mere driving through the soil is incomplete, and it must be turned by deep ploughing.

(2) That ploughing when the soil is dry soon after harvest, is conducive to its enrichment, as it lets the air, light and rain reach the soil.

(3) That plants in deep ploughed lands withstand drought better than in surface cultivated soils, and that plants in the former are free from diseases which attack the latter during drought.

(4) That at the rate of yield of plot No. I containing 2 mahs and 80 gulies (which ranged from 60 to 63 kalams for 2 crops) 1 veli of land can be rendered fit to yield more than 510 kalams when scarcely 100 kalams a veli is the average of the produce of similar lands in the said village.

P. SAVARAYA PILLAY.

WELL IRRIGATION.

SIR,—I see by your columns that a scheme for well irrigation is on the *tapis*. Of course if the Government undertake it, well and good; if not, I think it would be a good change for capitalists or a Joint Stock Co., to make wells, renting them to cultivators at a reasonable percentage on outlay. I have always advocated the multiplication of wells for irrigation purposes. A well will irrigate about 10 acres, and would be a great means of preventing, famines in the event of drought—in fact, if the Persian wheel was introduced into the N.-W. P. and Bengal, it would be a great improvement on the present means of irrigation by "dhoakis" or water-lifts used by natives. The cultivators themselves have not the means of making wells generally, but would not be glad to rent them. In fact the introduction of Artesian Wells would be a great advantage. I believe it has been used with great success by a gentleman in Madras, the cost being less than that of a well. India wants irrigation, and the introduction of a better kind of plough. I believe some experiments have been made at the Calcutta Jail with great success with a light American plough, costing about Rs 15. Its introduction would be an advantage, as by the wretched ploughs now in use by the natives, the soil has to be ploughed up 5 and 6 times before it is fit for sowing. The labors of the Famine Commission it is hoped, will develope a better system of irrigation and improved methods of working the land; but that great incubus, the money-lender, must be brought within bounds, as otherwise little improvement in the social condition of the cultivator can be hoped for.

PHILO.

Calcutta, January 8th, 1879.

GIRDLING APPLE TREES.

SIR,—The girdling of apple trees, is a practice which, though not generally known in England, has been adopted by many gardeners to improve and increase the yield of fruit. The process is a simple one and is carried out I believe, by stripping the bark off the lower branches or the main stem of the tree when the flower blossoms. I would like to know whether girdling has been tried in India, and if so, with what results.

The cultivation of the apple is carried on to a large extent in Bangalore from which place the fruit is sent to many parts of India. But it has only been within the past decade, that anything like scientific training has been brought into operation through the exertions of a few gentlemen here. Added to this a very large variety of the apple fruit has been imported from year to year, which having now been acclimatised grow in great luxuriance.

It would be interesting therefore to know what further improvements in *grafting* and *cultivating* could be introduced, and I should be glad if any of your numerous readers could give me hints or information through your columns on the subject matter of this letter.

THOS. J. LEONARD.

Bangalore, 2nd December 1878.

FERN CULTURE.

SIR,—*Cycadaceæ* require a rich sandy loam and moist heat, propagated by means of suckers. There are two species cultivated in Calcutta.

C. circinalis (round leaved), 3 feet high, found in India about 1800, yields a coarse sort of sago.

C. revoluta (rolled-back leaved), 3 feet high, found in China in 1737.

Zamia.—Soil as above, but require to be imported, as they do not propagate in India. They are indigenous in the Bahama Islands, Cape of Good Hope, New South Wales, and West Indies: In the latter

country arrowroot, of the finest quality, is made from *B. furfuracea*. In the Botanical Gardens, Calcutta, there are two or three species.

G. P. P.

THE SAME.

SIR,—Your correspondent Dr. Shortt, states that the seeds or nuts of the cycads "are eaten by the poor ground into a flour and cooked into a sort of a conjee." Now I would not advise any of your readers or your correspondent making a trial of it. Unless prepared as I shall describe, it has poisonous properties, and sometimes proves fatal, but generally causes severe vomiting, the only antidote for which is large doses of tamarind water, until the vomiting ceases. The plant is quite common all along the Western Ghats, in Travancore and Malabar, but is not found at any great height on the Hills. It often has two or three heads or branches. It seeds during the S.-W. monsoon, and sheds all its leaves in December or January, which its puts forth again after the first shower of rain, after the hot weather fires have burnt the forests The trunk of the plant contains a very large percentage of coarse fibre (I should say 74 per cent) which should make a good "half stock" for paper manufacture, and as good as that produced from bamboo. A transparent glutinous fluid like the white of an egg exudes from the tree when cut, and forms into a gum. The average from a tree will be about a quart; its properties are not yet discovered. The Kordars and Mulcers of the Anamalais live on the nuts for some months It is prepared in the following manner before being used as food. As soon as the nuts are ripe, which is when they assume an orange red or yellow colour, they are gathered and taken to a flat rock and cut open, in two, the kernels are taken out, sliced and dried out in the sun for three or four days, until the thumb-nail makes no impression on them by pinching; they are then gathered and soaked in a stream of running water for three full days, after which time they are dried and stored for use. The kernels are eaten roasted, or made into flour for conjee, or sweet cakes with the addition of honey. It contains, I think, a good quantity of starch, the taste after being prepared is not at all disagreeable. It is not eaten largely in Malabar or Travancore, but on the Anamalais, the nuts are not even allowed to become properly ripe before they are removed by the Hill men While on the subject of the above source of food of the wild tribes, I may as well mention another food supply of the Mulcers, and that is the ripe pulp of the tamarind which is quite common about the valleys of the Anamalais, they live on it for a month or two. I once had the opportunity of witnessing this strange banquet. A group of about a dozen half-naked, dirty men women, and children, were squatted around a fire made of a particular kind of wood (*Anogeissus latifolia*) and a heap of tamarind with the shell Each one took a piece removed the shell, rolled the pulp well into the ashes and then lifting up their woolly heads, and opening their hy ena like mouths, the fruit was put down their throats and swallowed, seeds, and all, each man and woman consuming three or four lbs at each meal. The object of the ashes was to remove the acidity of the fruit, and to prevent it acting on the bowels.

BIG BORE.

BAMBOO AS PAPER STOCK.

SIR,—Bamboo is largely used in China for paper manufacture. It is cut while still green, scraped, and cleaned, the fine shavings are steeped in water and reduced to a paste by a particular method, mixed with isinglass. This paste is converted into various kinds of paper Before being bleached the paper is smooth, soft, of great strength, the colour being light yellow. The coarse shavings are also made into thick sheets with which a very useful tinder is manufactured. The tinder is made with rolls of paper which are lighted, and when thoroughly ignited are thrust into small tubes of bamboo which are at once closed and the flame thus put out: the burnt roll can then be kindled with a flint and steel as required, blowing on it a few times lights it into a flame, being the only kind of tinder that possesses this peculiarity. Mixed with slaked lime the paste is made into a strong, useful and ornamental plaster for walls of buildings. The thicker shavings can also be used for stuffing cushions, pillows, &c.

I.

COFFEE LAND TAX IN MYSORE.

SIR,—Why have you not ere this published the Minute on taxing coffee lands in Mysore in your valuable paper? Mr Gordon, C. S. I., Chief Commissioner of Mysore, has published a Minute on coffee and sent the same to the Governor General for sanction.

Should the Government of India sanction what Mr. Gordon has asked them to do, it will ruin nine-tenths of the native coffee planters in Mysore. I will not take up much of your valuable space Mr. Editor but will show you how it will affect the natives. At present the natives as well as the Europeans pay an export tax of one rupee a cwt, or at any rate they are supposed to do so, but the native does not export his coffee; he sells it on the spot or at the nearest market town in his talook, so the merchant who purchases, and not the grower, pays the duty. Mr. Gordon proposes to levy a tax of one rupee eight annas an acre instead of export duty. The opinion of the Mysore Planters' Association has been asked for, and the reply is that one rupee an acre is as much as coffee land in Mysore can stand; the opinion of individual European planters has been asked for and replies from *five* of them have been received by Government; but Mr Gordon forgot to ask the opinion of a single native planter I have pointed out to you that the native does not pay anything just now, but the export duty is paid by the merchant Under Mr. Gordon's new scheme the native will have to pay the tax whether his lands produce any coffee or not. No warning has been given to the native that a tax will at any time be substituted for, and instead of the export duty, neither has his opinion been asked whether he would consent to the tax or not.

From and after the 1st of April 1879, the tax must be paid or rather ought to be paid, but 95 out of 100 of the natives will give up their holdings. They cannot afford at present to pay the tax proposed; they have had no warning, hundreds of them in fact will not know that a tax on their land has to be paid until they are called upon to pay down one rupee eight annas per acre for every acre they hold.

The Chief Commissioner's Minute on coffee is well written, but very misleading to the Government of India as far as the natives are concerned, and if it is true that the Chief Commissioner wishes to drive the native planter from his holding he will succeed without a doubt. I trust the Government will withhold its sanction to this paper until they are in possession of more information as to how the tax will affect natives. Give them a warning that after a time say three years, the tax will take effect, and then if they cannot afford to pay, it will be their own fault, but without any warning, to allow the natives to cultivate and make their places produce at least six maunds an acre, I think is most unfair. I have heard it whispered that Mr. Gordon wishes to drive the natives out of the way as far as coffee is concerned to allow of more Europeans coming into *Mysore*. I am as I have said above, certain that should this proposal of Mr. Gordon's become law, the natives must go to the wall, but I have my doubts as far as the Europeans are concerned

MORE ANON.

Kadur District Mysore, 22nd December, 1878

MUMMY PEAS.

SIR,—With reference to recent correspondence I may mention that when I was staying in the Isle of Man about the year 1852, my host obtained some mummy peas which germinated. The plants grown were trained against a wall and reached some 10 feet in height. They resembled the ordinary pea in every respect, except size. The pod was as long as a man's hand and contained 15 or more peas about the same size as what are known as marrow fats. I left the Island afterwards and can give no account of the subsequent experiments. My impression at the time was that the peas were the product of "repeated selection of the fittest" It would be interesting to know if such deteriorated afterwards to the original size.

C.S.

P S—If I remember rightly the peas were obtained from a mummy in the Exhibition of 1851.

KANS GRASS MR. SCHROTTKY'S REPORT.*

(*To the Editor of the Pioneer.*)

SIR,—Your reference, in a recent issue, to my report on kans grass, published lately in the *N.-W. P. Gazette*, with Mr. Cadell, the Banda Settlement Officer's review thereon, has recalled the subject to my mind and I hasten to correct a most serious error and an oversight of an important portion of my report, which underlies both yours and Mr Cadell's review. *It is precisely the error I foresaw, and which I* endeavoured to prevent by dwelling at some length, in my report, on the nature and the difference between *available* and *unavailable* plant food, which otherwise would have been quite out of place. I stated that on the basis of my experiments, and analysis of the different soils submitted to me, I have come to the conclusion that "an over-saturation of the soil with *available* lime and silica and *notably the latter*, is essential and necessary for the germination and development of kans." I would draw your attention to the words italicized. Mr. Cadell referring to the fact that some soils, also overrun with kans, are shown, by the results of ordinary chemical analysis, to contain much less lime than other soils which are never affected with kans, thinks that my conclusion that an over-saturation of the soil with available lime is

* See pages 53-56.

necessary for the development of kans, will probably require some modification. Probably it will, as it appears that the soils sent to me were by no means fair representatives of the chief classes of soils in which kans is found to be prevalent, but Mr. Cadell has overlooked the fact that I said *available* lime, the word *available* deriving special significance by my preceding remarks explaining the nature of a difference between *available* and *unavailable* plant food. Referring to my analyses of the soils, you will observe that ordinary chemical analysis shows the percentage of total lime in the three different soils.

	No. I. Kans.	No. II. Kans.	No. III. Kans.	Proportion.
Total Lime	6·50	10·60	9·09 per cent.	1 to 1·63 to 1·55

The available lime which may be considered as fairly represented by the average of what can be extracted from the soil by percolation with weak acids and water, stands in the following proportions.

In 1000 grs. of soil, extracted by weak acids.

	No. I.	No. II.	No. III.	Proportion.
Available lime	12·2,	30·3,	28·5 grs.	1 to 2·48 to 2·33

In 10,000 grs. of soil, extracted by distilled water.

Available lime	0·6,	10·3,	11·2 grs.	1 to 17·66 to 18·66

Average proportion of available lime in soil free from kans to that in soil overrun with kans 1 to 10·07 to 10·49

The proportion of *available* lime in the different soils varies therefore immensely from the proportion of the total quantity of lime, as shown by ordinary chemical analysis, and as only that proportion of lime which exists in the soil in the *available* state, can influence plant life, any conclusions based upon the relative quantities of available plant food which are found in soils, cannot be modified, or affected by the results of ordinary chemical analysis which gives available and unavailable plant food under one heading. As a matter of fact, ordinary chemical analysis may show two soils to contain say No. I., 5 per cent., No. II., 10 per cent. of lime, while the proportion of *available* lime in them may be the very reverse, *i.e.*, No. I. may contain 1 per cent, No. II., ½ per cent. Until therefore we know the proportion of *available* lime in *kabar* and *parua* soils, overgrown with kans, and its, proportion in the *same class* of soils, free from kans, we must still consider the question an open one. I wonder Mr. Cadell was not struck by the apparent incongruity of my recommending heavy dosing with lime as a remedy against kans, which I say is due to an excess of it in the soil. Add, however, the word *available*, with all the weight it carries in my report, and the apparent absurdity ceases to exist.

It does not matter how much lime there is in the soil, provided that there is no excess of it in that peculiar state of physical combination with the soil, in which alone it can influence plant life. But though from the results of my experiments and analyses, I was bound to consider over-saturation with available lime as an *accessary* in encouraging the germination and development of kans, and though Mr. Cadell has done well to draw attention to the fact that kans is likewise prevalent in soils, shown by ordinary chemical analysis to be less rich in lime, he has not, I think, drawn sufficient attention to the prominence I gave to available silica, as the *chief* cause of the spread of this pernicious weed. I said: "An over-saturation of the soil with available lime and silica, *and notably the latter*, is essential and necessary for the germination and development of kans."

EUGENE C. SCHROTTKY.

Calcutta, 28th December 1878.

HILL FARMING.

SIR,—*The Indian Agriculturist* couples my name with an enquiry, as to whether the public could not obtain some information as to the working of the Lawrence Asylum Farm, and enquires whether a statistical report could not be made, showing what the results are likely to be:

I believe a statistical report is annexed to the usual Annual Report of the Asylum, but as this report has but a very limited circulation, the public does no benefit much by the information given, and as I think the subject of Hill farming deserves a great deal more attention than it has received, I venture to offer the *Agriculturist* the benefit of my experience.

The question asked by the *Agriculturist* is "what may be expected of it?"—whether the Lawrence Asylum Farm, or farming in general is meant, I do not quite understand.

With regard to the L. A. Farm in particular, I have some doubt as to its success; it has a good deal to contend with. In the management of a farm, freedom of action is of the first importance, and this the Manager of a Government or semi-Government establishment cannot expect to have; the directing powers must and will have their say and way, whether they understand the matter or not, and the consequence is obstruction, and annoyance, and discouragement to those who are entrusted to carry out designs.

There is another matter that tells heavily on affairs of this kind, that are carried on by Government—*perquisites*. It seems to be a thing pretty generally understood that a man's Government pay should be augmented by perks, whenever an opportunity offers, and the farm authorities, in taking advantage of their chances, only follow a general rule. The perks from a farm are of course free table from farm supplies. I think I may, at a low estimate, put the loss down under this head at Rs. 2,000 per annum cash, and taking into account the demoralizing effect that such a system has, I think there is little chance of a Government Industrial Establishment being successful, in a pecuniary point of view.

I do not say the system of perks is wrong, I suppose it is a relic of the good old times; but I call attention to it, to show that supposing the L. A. Farm to turn out a failure, it is an item that should be taken into account.

The success, or non-success of the farm is of little direct importance to the public: what is required to be demonstrated is whether farming on the Hills is or is not likely to pay as a commercial speculation; and on this point I have very strong opinions; I say most unreservedly that it would. Always of course given that it was carried on under good management, the reasons I have for believing so are the following.

Compared with England.

1. Rent is much lower.
2. Taxes are almost *nil*.
3. The climate is better.
4. Growth is more rapid.
5. There are large areas of free pasture.
6. There is a greater length of growing season.
7. There is less competition.
8. There is, and always will be, an almost unlimited demand.

I know some of these statements will be disputed, particularly the last. I was often told when opening the farm, that it was no use to grow good things, that no one would buy them. I was also told (a thing that an Englishman ought to be ashamed to speak) that I should be beaten out of the market by native competitors, I prophesied differently, and experiences proved that I was right. The greatest difficulty the farm had to contend with was to meet demands. There seemed no limit to the business that could have been done, and this can easily be understood. Any one who has resided on the plains, knows how jaded the appetite becomes, and how eagerly it welcomes anything in the shape of change, especially anything in the shape of fresh vegetables or salad, and for the production of these things the climate and soil of the Hills are singularly suitable. The Neilgherries should be veritably the garden of Southern India and if a regular supply was organised, the consumption would be enormous, as they can be carried very long distances. I have sent supplies as far as Secundrabad, and they were reported as arriving fresh and good, and I have myself eaten vegetables, a week after their arrival in Madras, and when brought to table, they were in prime condition.

But it is not as a vegetable-producing district that we should look for prosperity, this at the best would be a limited branch of industry. What should be aimed at, is the production of meat, instead of the inhabitants of the Hills being dependent on the plains for supplying them with a lot of wretched, bare-boned, goat-haired abominations, in iscalled sheep, and good-for-nothing half-starved cattle, from whose bones it is difficult to pick a meal; we ought to be sending large supplies of well-fed meat to the plains.

I now proceed to show what I consider to be the capabilities of the Hills as a meat producing district.

The first and most important consideration is what description of stock is most suitable, and I have no hesitation in saying that sheep stand first. It seems to be believed that the Hills are unsuitable for sheep, on account of the heavy and continuous rainfall during the monsoons, but this argument is put forward, either without thought, or without knowledge of the condition under which the animal thrives. There is scarcely an animal so well protected against rainfall as the sheep; it's thick and only fleece is as nearly waterproof as the feathers of a duck, and it seems to have been a special provision for the protection of the animal from wet and cold. It will be said experience proves that excessive rainfall in England is highly injurious to sheep. True, but the circumstances are widely different. Heavy rain in England means poached and sodden land, and as sheep are generally folded, night as well as day, it follows that during these times they have no dry place to lie on, and this is certainly injurious; but here this would never occur; in the first place the land never becomes soddened, even during the heaviest rains, and half-an-hour after rain has ceased to fall, the pastures are perfecty drained. Secondly, it is compulsory to house sheep here as a protection from wild animals, and this, with ordinary care in the construction of buildings, would ensure their having dry and comfortable sleeping places. It is of importance

to remember that it is not the actual rainfall from which sheep suffer, but from the want of drainage. Some of the most unhealthy sheep farms in England have been converted into sweet and healthy pastures, by simply draining. The chief diseases from which sheep suffer in England are catarrh, and foot and belly rot. The first is doubtless caused by exposure, and lying on wet ground; the second from want of dry footing, and the last from feeding on sour, and badly drained pastures. They need not be exposed to any of these causes here, the undrained portion of hill land does not extend beyond the few swamps, scattered here and there, and no sane person would graze sheep on a swamp.

Again, it appears to me that Hills are the natural habitat of the sheep. I have never heard or read of them being found in their wild state in a low flat country. All the sheep and goat tribe are found on mountain ranges. It is also known that the meat from the sheep fed on mountains is superior in flavour to that fed on plains. These things show clearly that Hills are their natural home, and why should the Neilgherries be an exception? I maintain they are not. On the contrary that they are singularly suitable. As a rule Hilly districts are unsuitable for cultivation from the thinness of the surface soil, but here we have thousands of acres capable of being brought into the highest state of cultivation, and specially adapted for the growth of the turnip, the very thing on which successful sheep-feeding depends; and another thing of great importance in feeding—oilcake—is within easy reach. On the whole, I can hardly conceive a more favorable locality for the industry; here are the prospects; a delightful climate, immense areas of free pasture, a splendid turnip growing soil; Oilcake close at hand, and an unlimited demand for well-fed meat. These are the theories, now let us come to the facts. The L. A. Farm has a flock of sheep, the original flock of which was purchased locally, in common with all other animals on the Hills; they are of no distinct breed; they are brown faced, short woollen animals of pretty compact forms, and weighing, when fatted, about 12lbs. a quarter. They yield mutton as sweet as the celebrated Welsh meat so much prized at home. I take them to be about the stamp of animal suited to the Hills. The large heavy lowland sheep would be quite a mistake. To bring such animals here would be acting contrary to nature, small, lightmade animals are the things for Hill Ranges, all over the world. These sheep from their first arrival at the Farm, were very unfavourably situated; then sheds, not having been built for the purpose, had no drainage whatever, and the Farm, being always overstocked, it was impossible to make any provision to help them over the scarce season. So that in the dry season they suffered from a scarcity of food, and in the wet from a wet sleeping place, and still they throve fairly well. They never suffered from any epidemic disease. Not a single case of foot, belly rot or of fleece maggots occurred during the time I had charge of them, some three years. There was considerable mortality among the lambs, but nearly all this could have been prevented by good housing and suitable pasturage for the ewes.

So far theory and practice agree, we now come to the highly important matter. Supposing the foregoing to be correct, would it pay to breed them? This is the all important question, and here is what I know about the matter. I put up some wethers to feed, at 2½ years old; they were bred upon the estate, and up to the date of their being put up to feed, they had cost *absolutely nothing*. They had grazed their living from the time they were lambed; and the last of their herding and housing was amply repaid by the manure deposited during the nights. They were fed as follows:—a dozen were selected from the flock, and were driven out easy distances to pasture (uncultivated) up to about 1 P.M., previously having had a small feed of oilcake and turnips. During the afternoon they were again fed on oilcake and turnips; their allowance was 1 lb. of cake per diem, and turnips *ad libitum*, the latter was not weighed to them, but I should suppose they consumed about 8lbs per diem. Considering that two rupees per ton was the calculated cost of turnips, the latter item was not of much consequence. After six weeks feeding, six of the animals were brought to the knife, in prime condition, and they averaged about 40lbs each. The meat was bought readily at 6 annas per lb. We have thus:—

Cost of feeding per sheep 336lbs of turnips, about	...	0	5	0
...lbs. of cake	...	2	0	0
Rs.	...	2	5	0

PRODUCE.

40 lb. of mutton at 6 annas ... ... Rs.	...	15	0	0

The skin and offal are calculated to pay for killing, and distribution of meat.

I could go on much further on the subject, but I should think what I have said is enough to call attention to the matter. I will, before I conclude, call attention to the value of sheep as manure collectors, with a few women or children to collect ferns or other bedding, it is astonishing what a large quantity of rich manure a flock of sheep will give. Another important matter is that there is no necessity for being confined to a breeding season, the flock will breed all the year round. Many of the ewes at the Farm had three lambs in a year; two at one birth, and one at another. Keep them well fed, and there is no fear of deterioration from too frequent breeding.

J. BARNARD,
Late Bailiff, L. A. Farm.

AGRICULTURAL SCHOOLS FOR BENGAL.

To

A. W. CROFT, ESQ., M. A., DIRECTOR OF PUBLIC INSTRUCTION.

SIR,—With reference to the letter dated the 12th August 1878, I have the honor to submit the following sketch of a plan for imparting agricultural education in this country.

From time immemorial agriculture has been carried on in this country without the aid of any book or school instruction. The knowledge of the simple method which the farmers adopt for cultivation is acquired by tradition and observation of the practice of others.

The plan which I propose is to replace tradition and individual observation by school teaching, and to extend the scope of the teaching to the improved method of cultivation deducible from the application of science to agriculture. For this purpose I propose to establish classes in existing schools where instruction may be imparted on the following subjects: *viz*:—1st Elements of Botany; 2nd—Agricultural Chemistry; 3rd—The influence of climate on Agriculture; 4th—The character of soils and their relations to plants; 5th—The influence of seasons on Agriculture; 6th—Acclimatization on the introduction of foreign plants, and the conditions necessary for success in such operations; 7th—The invigoration and exhaustion of land, including ploughing, the employment of manures, the rotation of crops, and the influence of leaving lands fallow after cultivation; 8th—The employment of hitherto unused vegetable products to purposes of art and manufacture.

The first named subject must form the ground-work of all subsequent teaching and especial attention should be paid to it. At present, Botany forms a subject of study in many schools, but there is no fit book nor any teacher for it. The work required for Botanical instruction in this country should be practically treated, and illustrated with examples from native plants. It should also be so framed as to contain ample instruction bearing directly upon agriculture.

For the second subject there is also no work now available but the desideratum should be easily supplied.

Under the 3rd and subsequent heads, my work entitled the *Krishi Durpan* is the only one now available. It contains much information which if brought to the notice of agriculturists would be of great use, but it would be necessary to revise and extend it considerably for use in a college.

At the first start I would not suggest any thing that would involve heavy expenditure, my wish is to begin from a nucleus to be extended from time to time as it may prove successful. The first requirement is a complete staff of teachers, and, until this is produced, no school can be established with any prospect of success. To supply this desideratum, I propose first, to open an agricultural class in the Normal schools of Calcutta, Hooghly, Dacca, and Midnapore. Four teachers will be required for the purpose, and these I believe are available. It will be their duty to teach the subjects above enumerated, and at the same time to compile text-books.

At the beginning it will be necessary to offer special encouragement to the pupil-teachers who will attend this class, and I propose the increase of their stipend by four rupees monthly.

To control the action of the four teachers, and to give uniformity to the course of education proposed, it will be necessary to appoint a superintendent; who should attend each Normal school for two months every year, to deliver lectures and to manage the farm that should be attached to each school for the practical instruction of the students. The remainder of his time should be devoted to travelling in the country for collecting seeds and plants, which may be either introduced to the farm, or preserved for making a herbarium in each school for the Botanical study of the students.

When the supply of teachers available from the Normal schools shall warrant the measure, I would propose to open agricultural classes in zillah schools, grant-in-aid schools and village-schools, where the boys have passed the 16th year of their age.

As there are two classes of men in each profession, a managing class and a working-class, so in agricultural education it would be so arranged

as to produce in the higher schools a body of scientific agriculturists from the higher order of society, and in the lower schools it will be taught to cultivators, who will be thoroughly proficient in practical work.

To the former it may be at first desirable to give some encouragement such as remission of the school-fees. I am sure the poor boys will readily apply for their admittance to the agricultural class, and if they be allowed a share of the farm produce they will look upon it as ample.

In the zillah school of Baraset an agricultural class was once opened for the education of the boys in agriculture, but, for want of a teacher, this class had to be abolished. If the same class be again opened and all the lands formerly occupied by the model farm be granted for experimental purposes it should readily be revived.

In connection with the agricultural class in each school it will be, necessary to lay out a farm of not less than a hundred biggahs of land, for the practical instruction of the boys in a small part of it. Experiments of various kinds should be instituted, for improvement in the methods of cultivation and acclimatization; and, in the rest, indigenous cultivation should be carried on, for realizing a certain sum which may supply all the expenses of the farm and the cost of labour. As there is no means to keep a farm attached to the Calcutta Normal school, it is desirable that the students should attend the Imperial Botanical Garden for the practical study of botany and gardening. Their travelling expenses to the garden will amount to about Rs. 15 monthly.

Each farm will have to be supplied with the necessary implements including two ploughs and four bullocks.

A small laboratory and a monthly allowance for chemicals will have to be supplied to each Normal school. The total cost for these is not likely to be heavy.

HURRY MOHUN MOOKERJEE.

Calcutta :
Normal School, 21st October, 1878.

A NEW SOURCE OF REVENUE FOR INDIA.

To the Editor of the Paper Maker's Monthly Journal.

SIR,—In the concluding paragraph of my last letter, I proposed to, show "How Bamboo Paper Stock," produced under fairly favorable "conditions, can be brought into the market to compete with Esparto. both as to quality and cost."

1stly. As regards quality :—I have not shown the "Paper Stock" I have produced from Bamboo to a single paper maker who has not admitted its superiority to Esparto, both as regards its nominal strength, and the divisibility, fineness, and felting properties of its fibre : the raw dried stem also affords a much greater yield than Esparto, thereby demonstrating that it consists of more cellular tissue (generally termed cellulose) consequently not so much extraneous matter to get rid of, and it follows that less alkali is required for the boiling process, the boiled fibre bleaching as readily if not more so than Esparto,

Although it is well known that from time immemorial the bamboo has been employed for paper making by the Chinese, Japanese, and indeed more or less throughout India, hitherto only the old and matured stems have been used for such purpose, I do not pretend to say that paper, even of fair quality, cannot be made from the bamboo in this condition, but with age the stems naturally become woody, and can only be treated as the Chinese do by long continued maceration or destructive steeping or rotting, or as wood now is by high pressure boiling in strong caustic alkaline solutions, by which it is, like wood reduced to "pulp."

The system I adopt for producing fibrous "Paper Stock" is very different. I take the young herbaceous shoots or stems of the season's growth, cutting them while the sap is still flowing and before the silica, lignine, and other constituents of the sap have become deposited and indurated by age, passing them as freshly cut through crushing and slitting rolls, thereby abstracting much of the sappy matter; thus the pure fibre at this stage of growth is more readily and freely separated from these extraneous substances, and being produced in a *tow-like* condition by being willowed or teased out after boiling and washing, is, when dried, put up into hydraulic pressed bales for economy of freight (similar to cotton or jute), being ready for bleaching and the succeeding paper making processes when received by the manufacturer.

Having described the characteristics of the "Paper Stock" I propose to produce from the *young* bamboo, it may be well to point out the difference, both practically and commercially, between it and "pulp" resulting from the older stems.

In "pulp" then the cellular tissue existing in the old stems has by age been converted into ligneous tissue, in other words wood, and as remarked during such conversion the silica, lignine and other combined matters forming the substance of the stem have also become solidified and hardened, they therefore having to be got rid of, as it is only the true ligneous tissue which constitutes the "pulp," strong caustic alkali at an elevated temperature, *ergo* high pressure boiling, has to be resorted to render them soluble and removable, and as they form a very considerable portion by weight of the woody stems, it follows that the ultimate fibrous residue is considerably less than if the plant were taken in its young or herbaceous stage of growth, the fact being that the average yield of "pulp" from the old stems is only about 40 per cent. while that from the younger stems ranges from 60 to 70 per cent. (the results in either case being assessed from the stems when dried). In the old stems moreover certain coloring matters (as well as the silica and lignine) being deposited and fixed, even after boiling a more energetic and therefore more costly bleaching agency is required.

Neither is it possible to dry "pulp" so readily or so economically as the fibrous "Paper Stock," nor will it when dried pack into so small a bulk ; the freight and carriage charges, important items, are consequently more onerous.

So far, therefore, as regards the quality of bamboo "Paper Stock," of course I am aware that this, my statement, will only be accepted by many *cum grano*. I mean that as bamboo and the "Paper Stock" produced thereform is not as yet commercially known in the market it can only be judged by the somewhat limited trials I have made, the results of which may be seen from the specimens of paper and "Paper Stock" at the rooms of the Association.

However good or suitable the quality of any fibre may be, especially if proposed for paper-making, seeing the present low price at which paper has to be produced, the crucial question after all is cost, and unless this essential element can be brought within reasonable limits, success is hopeless.

The main, or rather the immediate difficulty, in this connection is that bamboo as a purely *raw* material cannot possibly be imported into this country on account of its bulk and lightness, and consequent cost for freight ; it follows therefore that it must be converted into "Stock" where it grows or is produced. In this respect however it only resembles other fibrous plants of an equally bulky nature (in their raw or natural condition), such as jute, flax, hemp, &c., from all of which the ultimate fibres as articles of commerce are produced by somewhat complicated processes, besides which such plants involve costly system of cultivation which the bamboo does not.

Growing extensively in most warm countries, the bamboo is essentially indigenous to the Tropics, and even there its most prolific growth is governed, or at least modified, by climatic influences, being, although not an aquatic, still a water-loving plant, and therefore flourishing best in a very moist climate, such for instance as British Burmah and the Tenasserim Provinces, the Straits of Malacca and the Islands of the Indian Archipelago. It abounds in South Western India and Ceylon, in most of the West India Islands, Central America, and the Brazils ; in China also and Japan it is most abundant ; in Southern India it forms in many districts dense and almost impenetrable jungles.

The bamboo is perennial, that is the parent stool or clump lasting many years, with most species from 50 to 60, when, having reached maturity, the plant flowers, seeds, and generally dies ; young plants then spring up from the seeds thus shed, forming the dense jungles or forests alluded to.

When the seeding occurs, which it frequently does over a wide district, the grain, somewhat like coarse rice, is eagerly collected by the natives, constituting a nutritive article of food.

The natural habit of the bamboo is that each clump or root-stock produces a growth of young shoots each year, from 8 to 10 or more, these being thrown up at the rainy season common to most tropical countries ; these shoots attain their full height in a few weeks, ranging according to the variety of the bamboo and the age of the parent stool, from 30 to 60 feet high or more (some species, *Bambusa Gigantea* for example attaining the height of 120 feet). If only a portion of these young season's shoots are cut, leaving say from one-fourth to one-third to maintain the vegetative functions of the plant, it will retain its natural vigour for a lengthened period.

From the foregoing it will be evident that an abundant, I may indeed say an illimitable supply of the raw fibrous material exists. I will consider in my next letter under what conditions this valuable paper-making material may be made available for the exigencies of our trade.

THOS. ROUTLEDGE.

Claxheugh, Sunderland,
27th October, 1878.

The Indian Agriculturist.

CALCUTTA, FEBRUARY 1, 1879.

THE MADRAS RYOTS.

"THE Blacker Pamphlet" tells us that the ryots of the Madras Presidency have been burdened by grievous over-assessments, and the author, Mr. H. A. D. Phillips, of the Bengal Civil Service, advocates the introduction of a permanent settlement. No fault is found with the ryotwari system *per se*: but the writer urges that the system has been abused by the Madras Government; who, in the matter of assessment and collections, have been judges in their own cause. The Bellary district is taken as an example of Madras settlements, and it is shown that the revenue demand has had to be reduced over and over again owing to over-assessment. The demand in Monro's time was 55 lakhs of rupees: in 1822 it had been reduced to 38 lakhs, and in 1857 to 34 lakhs. In 1874-75 it was only 25 lakhs. The writer shows that since 1857 there has been a more liberal policy, which was beginning to show its good effect previous to the famine: and he is of opinion that, if the present assessment, which he considers fair, were made permanent, 'the ryots would become a prosperous peasantry. The ryots pay in their revenue, direct to Government. They are, in fact simply zemindars: that they have remained petty zemindars, is due to the fact that high assessments and prohibitive rules have rendered the land of little value. For this reason, there are few large holders, notwithstanding the fact that there is every facility for obtaining land. It appears that more than half the total number of ryots pay less than Rs. 10, as annual revenue to Government. Though it is easy to obtain land, the opposition of the reddies or village-heads prevents it. The ryots are jealous of outsiders, and rather than let them take up land, they apply for it themselves, throwing it up after perhaps a year's cultivation. The exercise of this jealousy is facilitated by the rules of pre-emption, which hold in the allotment of land. "It is only by bribing the reddies," says the writer, "that land can be obtained, and they *par excellence* are interested in keeping out of the village, educated and influential outsiders, who might harm them by supplanting their influence, and bringing to light their numerous oppressions and peculations. It is easy for an official to say—"Let influential capitalists ignore reddies and tehsildars: we shall receive them with open arms, and give them as much land as they like to take." Can the outsider afford to ignore the village head? We all know the power of exaction possessed by a paltry process-peon on Rs. 6 a month. He is armed with Government authority: he is part and parcel of the *Sirkar*. What shall we say of the village reddie, who possesses magisterial powers and collects the revenues?"

The writer proceeds to give instances of many rules which bear hardly on the ryot, and throw obstacles in the way of improved cultivation. Formerly if a ryot grew a second crop on wet land, he was bound to pay the full assessment over again. "No wonder that double-cropping was a dangerous experiment. The second crop might prove a failure, and the cultivator would be a heavy loser. In this respect the Madras Government, which is in the position of a zemindar to the ryots, appears to have out-Heroded Herod, and to have surpassed the most wanton and extortionate exactions ever indulged in, by the much-abused landlords of Bengal." The rule has since been modified, and now a *Fasl jasti* of 50 per cent. is added to the assessment, if a second crop is sown. The writer points out that even this charge is indefensible; "Land is first assessed high, because it is near a tank; and then extra assessment is put on when the water is used. If the *Fasl jasti* be called a water-rate, then the land ought to be assessed as dry land: and the water-rate should be levied separately, as in the Godavery and Kistna deltas. To call the second crop assessment a water-rate, is absurd. A ryot pays a high wet assessment, because of the advantage he enjoys of being able to wet or irrigate his land. But if he *does* wet or irrigate his land, that is, if he uses the advantage which he possesses, then he must pay extra for it. The ryot thus pays twice over, for the same thing: he pays for his cake, and then he pays for eating it." The reason given for the paucity of wells is that formerly, land irrigated by private wells was assessed as wet land. Thus, there was no incentive to dig wells. Since 1860 only, the highest dry assessment has been charged, but the writer points out that no additional assessment whatever should be levied on account of new wells constructed by the ryots. Again,—the rules of remission, are very uncertain, and the taking up of new land is something very like gambling. "The following figures indicate that ryots in Madras may be crushed by heavy payments for waste land, perhaps rendered uncultivable by a bad season. In 1874-75, out of 2,211,777 acres, assessed at Rs. 25,38,251, which the ryots left waste out of their holdings, they were only allowed a remission of Rs. 2,66,552 on 77,067 acres. Again, in 1875-76, of the total area in ryots' holdings left uncultivated, 2,229,719 acres were charged, and the assessment thereon, Rs. 23,55,748 was included in the demand." The writer argues that the fact that the revenue demand has undergone gradual decrease, proves that the land assessment from the commencement was crushing, indeed overwhelming, or if this position be denied, the other horn of the dilemma must be chosen. "It has been shewn," the writer says, "that rents are even at the present day by no means low. They are perhaps fair. If something over twenty lakhs is now a fair demand, what shall be said of a demand of fifty lakhs seventy years ago."

Again:—a punitive assessment is imposed, if land be taken up without previous application. The writer shows that this rule often works hardly on the cultivator, as poor men with little capital naturally hang on as long as they can, to see if the season is likely to turn out favourable. "A propitious moment for ploughing or sowing comes, and there is no time to lose. It is hard to make a man dance attendance at the tehsildar's office, at such critical moments." The writer gives one remarkable proof of the former harshness of Government as the zemindar. It seems that ryots were constantly deserting the Government land, and cultivating inam lands which they were enabled to rent on very favourable terms. To prevent this, a tax called "inam ruffisk" was imposed on those who cultivated for inamdars. "This tax," says the writer, "was as great a shock to the security of private property as can well be imagined. In 1856, Mr. Pelly recommended its abolition, as it led to injurious interference, and urged that *if only the assessment were lowered, there would be no fear of ryots deserting Sirkar for inam land.* These remarks are worth dwelling on for a moment. Here were private landlords, actually taking less rent than the Government. Which was the exacting and extortionate zemindar—the inamdar or the Government? The fact is, as has been remarked above, that private landlords are actuated by motives of enlightened self-interest." The necessity for such a measure as the above, indicates that the back of the ryot had been broken by heavy assessments.

Mr. Phillips shows that whereas in Bengal custom and status have to a great extent been ousted by the advent of competition and contract, in Madras many customs had been stereotyped and given the force of law. It is urged that there are bad customs as well as good. The proposal to give greater power to village *punchayets*, is condemned in strong terms. "We are afraid these persons belong to the category of *laudatores temporis acti.*

The writer thinks that it is due to the permanent settlement that there has been no declared famine in Bengal this year. The price of food grains has in many districts been even higher than anything known in 1873-74. At such times, zemindars can do much good by executing private works, and underselling the banians. In Madras everything is left to Government. "At present," says the writer, "where is the class that could guarantee the interest on new railways, such as the zemindars of Patna, Gya, and Mymensing, have done. Leave the rents low: leave the ryots a large margin of profit, and such a class will speedily be created." The writer in another place says "an equable and fair assessment, rendered permanent, must result in the same good for Madras as it has for Bengal. The wealth of a Government lies in the wealth of its subjects: and if they be overburdened, cultivation is checked, and trade

cannot expand. As in Bengal, so in Madras, loss of land revenue will be amply repaid by increased receipts under other heads: by the increase of cultivation, the expansion of trade and commerce, the prosperity of the peasantry, and the creation of a wealthy and influential middle-class, which acts as a buffer between the Government and the masses. Then, and not till then, will the Government rest free from the nightmare of deficits and the horrors of famine."

We have given Mr. Phillips' views as fairly as it is possible we believe to state them; but it is strange that he should regard "a permanent" settlement, as the proper remedy for unduly high assessments. As a fact, the Madras assessments were intended to be permanent. If unduly heavy, they will crush the ryot, whether the assessment is permanent or annual. The right remedy is light assessments under leases subject to periodical revision. We believe the 30 years lease to be too long, in the true interests of all parties thereto, but the principle is right.

ARAKAN TOBACCO.

IT is very satisfactory to learn that as a result of the establishment of a Government Tobacco Farm in the Arakan Hills several maunds of unmanufactured tobacco cured on the spot have been despatched to the London and local markets for report. They will we trust elicit from the most competent and practical judges a careful and well matured opinion. Most of the tobacco was we understand grown on the Farm, and a large portion consists of leaf of a remarkably fine description raised from seed of the American and "Manilla" varieties introduced into the hills some years back. It was on leaf of this tobacco, but *cured* in their own rough way by the tribes, that Mr. Broughton, the Government Quinologist, Madras, reported in 1874:

"I have the honor to report on a sample of tobacco grown in "Northern Arakan. The tobacco yielded 23·45 per cent. ash. "This ash contained 8·59 per cent. of potassic carbonate. By "determination the tobacco was found to contain 1·95 per cent. of "nicotine. These results show that the tobacco contains important "constituents in amount closely resembling those which are the "most *favorite* tobaccos of European smokers, or the Havannah "and Manilla tobaccos of the English market. Like all the "tobaccos from British Burmah, its qualities are most encouraging "and show that its site of growth will produce tobacco quite "worthy of export. The sample sent is worth sending to the "Home market."

It cannot be expected that what has now been cured on the Farm will compete with the fragrant leaf of the West Indian and American varieties, which the experience and work of *years* has brought to such perfection, but we are sanguine that it will be found a good marketable product and admit after *manufacture* of a ready sale. The experiment will further demonstrate what has long been urged for the Arakan Hills, that a country possessing the climatic conditions and soil to yield tobacco of such luxuriant growth and size as that raised on the Farm this season (many of the leaves measuring 3 by 1½ feet) abounds with latent wealth, and as such offers special attractions to the capitalist. It would seem that the Arakan Hills are capable of great development. We understand that the application of an English gentleman for a grant of 2,000 acres in the vicinity of the Farm has been received very favourably by the Supreme Government. With order secured amongst the tribes, there is every reason to believe that the province will become one of the most important in the Empire. The permanent steam communication recently opened up between the hills and port of Akyab will greatly facilitate the importation of labor and the opening up of the hill country. If the Farm-cured tobacco be favourably reported on in the English market, it is worth consideration whether Government might not advantageously confine itself to buying up the leaf grown throughout the hills, and by improved curing, render it fit for home consumption. *This* however would lie more within the sphere of private enterprise, and should with the other established products, oil seeds, cotton, &c., afford ample room for the merchant pioneer of commerce. An epidemic of cholera on the Farm during the year together with the illness and absence of the Superintendent added considerably to the difficulties which attend most new projects at their outset, while the absence of all steady labor in a country with a population of only about fourteen to a square mile the greater part of the season, further restricted the operations. Notwithstanding these minor obstacles however, the Farm has been productive of much *indirect* good by giving an impetus to cultivation, and introducing new products which have induced immigrants to settle down in this locality, so that viewed on the whole it may be conceded to have amply secured the object of its establishment, and should by next year if it be continued, with efficient superintendence prove a financial success.

SUNN FLAX.

IN the Punjab, Sunn Flax is generally grown in narrow strips along the edges of fields of cotton or pulse, though in places in patches alone; it is generally sown about the month of April and irrigated up to the rains, though some cultivators sow it just after the first shower in June; the April sowing gives the best result. About the end of August or beginning of September the plant flowers, and will be from 6 to 9 feet in height. If fine soft fibre is required, cut the stalks while still in flower; if strength (for cordage, &c.), when the seed is formed, but just before it ripens. The plants are either cut, or pulled up by the roots like ordinary flax; the former method is preferable, the operation being done with a native sickle. After being cut the stalks are steeped—in clean water, if possible—the duration being dependant on the season of the year, and climate. In August or September—in warm situations—2 or 3 days are sufficient for the fine soft fibre, but from 6 to 8 days if required for strength, and the completion of the process is known by the readiness with which the bark separates. When ready, the labourers take up the stalks, lay them in hand-bundles on the bank, and then take them up in handfuls by one end, and beat them on the water to remove the glutinous matter from the fibre; the stalks are then turned end for end and again treated in the same manner, after which the fibre is washed, the pith removed, and hung up on branches of trees to dry. The sap and vegetable matters should be separated from the fibre as quickly as possible, as it is the fermentation of these substances that hastens the decay and consequent weakening of the manufactured article. The object of steeping is to separate the bark from the woody part of the stem by dissolving the glutinous matter which causes it to adhere, and also destroying some minute vessels which are interwoven with the longitudinal fibres and keep them together in a kind of web. *A certain fermentation or incipient putrefaction is excited by the steeping, which must be carefully watched and stopped at the right time, or the fibres will become rotten.* It takes about 25 seers (50lbs.) of seed to sow an acre, and it is believed that an acre will yield between eight and nine maunds (80lbs. to the maund).

Sunn flax thrives best in a high and dry situation; a clayey, low-lying soil is bad, while too rich a soil produces coarse fibres. It is cultivated up to an elevation of 2,500 feet above sea-level, and is grown all over India. In Travancore it is called *Wakunnar* in Bengal, *Biljanjan*, and in the Punjab, *Niha sunn*. It is produced in large quantities in the neighbourhood of Jubbulpore. Locality and climate slightly change the growth, but all belong to one and the same plant, *viz.*, the *Crotalaria juncea*. It is very similar to the Spanish Broom *Spartium junceum*, well-known in England for the tough fibrous nature of its branch twigs It should not be mistaken for the *Hibiscus cannabinus* (Vern. *sankokra patsan*) which is inferior in strength. It is sometimes called the female of the *Hibiscus cannabinus*. It is exported to Europe under the names of Bombay hemp, brown hemp, Concanee hemp, Salsette hemp, &c. The fibre is used for cordage, fishing nets, ropes, strong packing-cloth, stout gunny-cloth, &c., and it is preferable to Russian flax for spinning. It has been tested up to a strain of 170 lbs. without breaking.

Dr. Royle, in his *Fibrous Plants of India*, gives some interesting particulars about Sunn flax. The earliest treatise on the Sunn plant was written by Wisset in 1804. The seeds are officinal—used to purify the blood in special diseases. It belongs to the N. O. *Leguminosæ*: the seeds are flat, irregular in shape, oval or triangular, deep concave, surface smooth, or with one or two ridges; color, pale yellow to deep brown. Though called hemp, its has no connection with the true hemp *cannabis Indica*. A simple description of machinery would cheapen the present cost of preparation.

THE BANGALORE EXPERIMENTAL FARM.

AFTER not quite four years of more or less successful existence, the experimental Station at Bangalore is to be closed. I use the word Station advisedly, as it is better understood than the term *Farm*, which has a commercial ring in it, and I would suggest its adoption to all scientific agriculturists, who may be at any time engaged in endeavours to improve the agriculture of this country. Farms, so called model, have fallen into disrepute with the Indian public, being too much in advance of the capacity of the native farmer to appreciate.

Model Farms, cultivated in the very best manner, are institutions which can only be of use where the community, for whose benefit they are designed, is sufficiently free from the prejudices of custom, superstition, and ignorance, which are so strongly developed in the Indian ryot, to be able and willing to adopt anything out of the common, which it may see anywhere adopted with profitable results. When education has reached the cultivating classes of this country; when science has by her enlightening influences aided in dispelling the clouds of superstition; and when time-honored custom is no longer the hard and fast rule of the farmer of our national properties; then perhaps Model Farms will serve a useful purpose. Until then all those interested in Indian agriculture had better, I believe, bury the term in oblivion, and endeavour to wipe out the memory of past failures; failures though they be owing simply to the misguided endeavours of civilian amateurs. Nothing should be left, if possible, to allow of such futile and ill-directed attempts being confounded with the movement which has of late years commenced in Madras, and which is now surging northwards rapidly. Bombay having decided on following the example of the Southern Presidency, and in no mean or half-hearted manner: let us hope that ere long Bengal will relieve herself of the reproach of being one of the last to see in what lies the true interests of the country and the people.

But to return to the Bangalore Station, of which I sent you a short description some months ago. It is to be closed as soon as Mr. Harman, the Superintendent, can be got rid of, which is not an easy matter, unless it be true, as is reported, that that gentleman is going to take up a professorship of Agriculture in the Poonah College. The only satisfactory part of this change is the sphere of extended usefulness to which Mr. Harman will be transferred; coming to his new post with several years of Indian experience, he will start on more advantageous terms than it has yet been possible for any agriculturist to do, and no doubt will ere long be able to feel the satisfaction of having made some real progress in educating the public on agricultural topics.

The waste of public money in closing such an institution as that at Bangalore, after so short, and what has been on the whole so satisfactory a trial, is and must be great, for in preparing such a place for experimental work, much labor and expense had to be incurred, the return of which is doubtful *now*. Why in a country just recovering from famine, and therefore all the more necessitous of an improved system of husbandry, it should be one of the first to suffer retrenchments, is a matter of mystery to any one, who is not aware of the pitch to which the penny-wise and pound-foolish policy is carried in this country. The money, so often wasted, or, if not actually wasted, ill spent in irrigation works of doubtful value, would do far more real good, and tend to a far more stable prosperity, if spent in well-devised, and strenuously executed measures of agricultural reform. It is to be feared that the money saved (?) by closing the Bangalore Station may be spent on the manufacture of tanks, for the extension of the growth of the worst crop, in every respect, cultivated in Southern India—namely, paddy, a crop only fitted for growth in malarious swamps, and pestiferous deltas.

With such a specimen of their obtuseness before us what can we expect the Government of India to do themselves, with a view to improve the condition of the ryots. The latter illiterate; ignorant of almost every thing, but what has been time-honored, as regards farming; superstitious to an almost incredible degree; sunk almost hopelessly into debt under the hands of ravenous usurers; permitted to treat national property, in the shape of the soil they cultivate, just as they in their ignorance please; is it surprising that the country is retrograding in agricultural prosperity at a pace, which increasing year by year and season by season, must before long, unless measures wide-reaching and well carried out are put in execution, must, I say, soon land the country in irretrievable bankruptcy? The soil is India's sole source of wealth at present—the source of her revenue, and will if the treatment of it which has been allowed to go on unchecked until now, is not put a stop to, be the source of her ruin. Called upon to support an increasing population, less and less manured year by year, cultivated with an implement which can but scratch, is it likely that the soil can long continue to pay the rents which are put upon it? And yet our rulers do not make any move in the matter except backwards. It is time that all who have the real interests of India at heart—and in her interests agriculture holds the foremost place—should combine to press on Government the urgency of the need, the greatness of the danger of delay, the necessity for immediate action. The time has come when the public should make their voice heard, and should; do our rulers decline to open their eyes to the danger, make what efforts they can on their own behalf to arrest the evil. Nothing effective can be done until the Legislature steps in to stop indiscriminate and ill-guided cultivation; to relieve the burden of debt; and set its face against the practice of entertaining tenants on Government lands, who have not the requisite capital to conduct the cultivation of the lands they hold in a fitting manner.

AGRICOLA.

6th January, 1879.

EDITORIAL NOTES.

WE have before us an interesting sign of the progressiveness of the age in the form of a pamphlet entitled the *Kaira Agricultural Record*, being the first of a series of papers it is intended to circulate among the agricultural classes by "The Committee for the Encouragement of Practical Agriculture" at Neriad in Guzerat. The brochure forwarded to us is an English translation from the Guzeratee. In the course of some introductory remarks we are told that it is to encourage the spirit of enquiry that impoverished lands and decreasing returns have aroused amongst the cultivating classes that this committee has been formed: "We have done what we could with the means at our disposal. As no agricultural education is available in this Presidency, we have sent some of our Patidar lads to study in the Madras College, hoping that the information which they will there acquire will be of use hereafter to the cultivators of this district. We have also arranged for the supply of the ploughs which have been most successful in Madras, and we have sent a practical man to the Madras Farm to receive instruction in the use of those implements. Some experiments have also been made in the manufacture of bone-dust for manure."

This is most gratifying news: pregnant with promise of a bright future, and we earnestly hope that the Neriad reformers will not be discouraged by the small difficulties that will beset their path at the outset. Let them but have their heart in the work, and persevere with it, and the benefits they will confer upon Western India and the country at large are inestimable. The immediate object of the society is to distribute in a popular form simple information that will be of practical use to the cultivators, and to encourage the ryots to seek knowledge. This first part consists of an account of Mr. Robertson's recent visit to Neriad, and includes some useful hints on the subject of ploughing and manuring. In some of the land examined by Mr. Robertson "pits had already been dug at the instance of the committee, and were deepened by Mr. Robertson's direction and the sub-soil examined. The result of this examination was astonishing. *Rich virgin soil, which had never before seen the light of day*, was stirred at every stroke of the spade, and when these experiments were repeated with precisely similar results in other fields, Mr. Robertson told us that we were happy in the possession of some of the finest soil he had ever seen." In the next issue of the *Record* we are promised a paper on the subject of the use of male buffaloes for agricultural operations in Guzerat, and we are pleased to see that a prize of Rs. 50 has been offered by one of the members of the committee for the best pair of male buffaloes trained for ploughing.

WE have not yet found time to notice Mr. Digby's two admirable volumes, on the Madras famine. We are obliged however to

dissent from certain of his conclusions, and hope to find an early opportunity of reviewing them. Thus he evidently entertains the belief which actuated the Supreme Government throughout the famine, that "the merest suspicion that the Government intended "to enter the market, would instantly paralyse the private trade. "No human being within the district which the Government had "taken as its sphere would ever obtain a pound of food save from "Government stores so long as the famine lasted. And this it is "which renders the question of Indian famines so profoundly "embarrassing. The grain trade does really, under particular "circumstances, fail to fill a space which the Government is "bound to occupy; but if it occupies this void a minute to soon, "or takes this necessary step with an amount of ostentation "which causes its purpose to be misconstrued, it instantly destroys "a power, on the whole vastly more valuable and efficient than its "own, and ends by starving its tens of thousands where it meant "to feed its thousands."

It is sheer delusion. The facts disprove the belief absolutely, but in India, we are accustomed at once to reply, "so much the worse for the facts." We have seen over and over again, that the certainty of high prices is all the stimulus that is needed, to set as much private enterprise in motion, as the country will yield. The fact that the Government poured 400,000 tons of food into Behar, in 1873-74 did not arrest for an instant, the pouring in of another 400,000 tons by private enterprise from the Punjab and Upper India. We have encountered but one famine as yet successfully, while so strong are ancient prejudices and mental pre-occupations upon the subject, that the very measures which were then successful, would have failed to a certainty, we are told, in Madras. Why should they have failed there, any more than in Behar? The strength of traditions and prejudices amongst officials in this country, is overwhelming.

The Act that was passed last Session of Parliament called the "Weights and Measures Act, 1878," came into operation on the 1st of January. The great object of the Act, is to secure uniformity of weights and measures throughout the United Kingdom, where notwithstanding the imperial standards, the confusion that prevails is almost as great as in this country. Local measures have hitherto held their ground, against every attempt to introduce uniformity. Not only was there no uniformity in the unit of measure, but "quarters," "bushels," "hundred-weights" "bolls," or "sacks" meant different measures in different places. The confusion in weights was almost as great, and it was with a view to rectify these anomalies, that the Act of last Session was passed. From the 1st of the present month, according to the 23rd and 24th clauses of this Act :—

"Any person who prints, and any clerk of a market or other person who makes, any return price list, price current, or any journal or other paper containing price list, or price current, in which the denomination weights and measures quoted, or referred to, denotes or implies a greater or less weight or measure than is denoted or implied by the same denomination of the imperial weights and measures under this Act, shall be liable to a fine not exceeding 10s. for every copy of every such return, price list, price current, journal, or other paper which he publishes.

"Every person who uses or has in his possession for use for trade, a weight or measure, which is not of the denomination of some Board of Trade standard, shall be liable to a fine not exceeding £5; or in the case of a second offence £10 and the weight or measure shall be liable to be forfeited."

It is now illegal in England, to use any weight which is not some fraction or multiple of the imperial pound, any measure of length not derived from the standard yard, or any measure of weight or capacity, not derived from the imperial standard pound. "Heaped measure" is abolished, and the vessel only filled to the brim. The existing sub-divisions of the pound measure are to be of course retained, and no change is made in Troy and apothecaries' weight. The law is aimed at the local customs of trade. Bargains in any but imperial weights and measures are now illegal, and subject to a fine of 40s. for every sale made. Local standards are to be provided by the Board of Trade and are to be subject to verification at least once in five years.

Now if Mr. Whitley Stokes instead of spending his strength upon the framing of new Legislative Acts, that only bewilder the people, encumber the Statute Book, and fill the Courts with new litigation, would take up the long neglected subject of Indian weights and measures, he might leave behind him grateful memories in India. The first step would be to measure the extent of the evil, and it is almost infinite. We shew ourselves at times as timid in our legislation, as we are generally rash and hasty. We believe that we might long since have dealt with the great evil under notice, with the strong sympathy and approval of the people.

The disappearance of the usury laws from the Indian Statute Book, is we observe being commented upon at home. Mr. St. George Tucker writes to the *Times*, that the mistake which our Legislature has made, has been the compelling of our civil courts to aid and abet the usurer. Indian judges have been denied the liberty of modifying usurious contracts. Sir George Campbell, when head of the judicial administration in Oude, limited interest to be decreed, to 50 per cent. of the principal; but the bond, the whole bond, and nothing but the bond is considered to be the perfection of civil court wisdom in India, as a rule.

"The Parliament of Roumania is showing an example of wise legislation by placing restrictions on the alienation of land. After the rebellion in Oude had been suppressed in 1858, the Government determined to authorize the barons or great talookdars to give away, sell, or devise their estates at their pleasure. So distasteful was this to noblemen whom Government wished to honour, and on whom it fancied that it was conferring valuable privileges, that in January 1862, almost all the chiefs of Rajpoot clans, advised by Rajah Hunwunt Singh of Dharoopore and Rolakonkur, signed a petition to his Excellency the Viceroy humbly begging that the supposed boon might not be conferred on their families, but, on the contrary, that any alienation of their lands should be restricted by Hindoo laws and by ancient customs, in accordance with which the noble Rohuttrees had held the greater part of the Gangetic valley for hundreds of years."

Every official in India, down to the assistant magistrate, knows that our civil courts have become hateful to the masses of our Indian subjects, because those courts have become the tools of the rapacity of the usurer. Mr. Robert H. Elliott very opportunely points out the practice in the Nizam's Civil Courts in the words of a native official.

"By our civil laws, our ryots are protected as far as possible from money-lenders, for in our courts a mere execution of the bond on which the claim rests, does not make a contending, or absent debtor, liable for the amount sued for, until the creditor should have proved to the satisfaction of the court the consideration for which the bond is executed. And if, on going over the accounts, it is found that a usurious rate of interest has been charged, the court at once reduces it to a reasonable rate. In the execution of a decree against the property of a ryot, his house, his agricultural implements, and a supply of grain sufficient to keep him and his family for six months are exempted from attachment, and this wise measure saves the cultivator from beggary and ruin. In these days of reforms and innovations, I earnestly hope and trust that this wise and beneficent rule will not be meddled with."

Thus in the Nizam's dominions, a peasant is recognized as a child, and treated accordingly. In our own districts, he is regarded as if he were an Englishman with a lawyer at command. When the ryot comes to complain that he is in difficulties through his ignorance of the low, we tell him, "*Ignorantia juris non excusat.*" If this does not satisfy him, we tell him of the law of *caveat emptor*, and so on. No one could speak more bitterly of the existing law than our judges themselves. "The Civil Courts" says one of them "often become the direct cause of the cultivator's misery." There is something radically wrong with our administrative system, when no remedy can be applied by us to evils universally admitted and which are clearly susceptible of modification. Here again is work for Mr. Whitely Stookes of the right order.

The office of Superintendent of the Botanical Gardens and Parks on the Neilgherries, extracts from whose last annual report we print below, is no sinecure. Mr. Jamieson has charge of the Ooty Garden, the Medicinal Garden, Upper Norwood, Stonehouse Park, Sunning Dale, Sim's Park, Burliar and Kulhutti gardens. The gross receipts of the Government gardens were Rs. 2,987-10-3. The Government very properly suggest that the seeds available in the gardens should be regularly advertised for sale in the newspapers, and that the public should be put in early and full possession of the results of experience gained in the cultivation of the

Liberian and West Indian coffee plants, with a history of the treatment of the plants and full particulars as to growth, &c. We hope that the wishes of Government will be carried out. The medicinal gardens where the jalap, ipecacuanha and other plants grow, promise to be successful. At Burliar the ipecacuanha plants thrive under partial shade. Sim's Park, established in honor of the late senior member of the Madras Council, is doing well, the expenditure in the year 1877-78 having been Rs. 2,589. The Kulhutti gardens were not remunerative; the sale proceeds of the plants were small, and Mr. Jamieson recommends that the plantation be sold. It is thought that Sim's Park, which is progressing most satisfactorily, will need all the time and attention that the superintendent can devote to it.

A Rangoon correspondent tells us that the Olive has just been discovered growing wild in groves, in British Burmah, by Mr. C. G. Forbes, Deputy Commissioner of the Tharawaddy district. Should this information be confirmed, it will be very important. These wild olives are said to flourish luxuriantly in many parts of the new district of Tharawaddy. The tree appears to be of much more rapid growth than the Italian tree, for while the latter takes from twelve to fifteen years to come to maturity, this Burmese species fruits after three years, and the fact that groves of these trees are growing wild in the plains near Thongzai, exposed to the great heats of March and April and to the heavy monsoon rains, proves that they are very hardy. The strange thing is that we have not heard of them before. It seems that the Burmese make a pickle out of the fruit with salt and water, but it is thought it would answer admirably for oil. If such is the case, and the necessary machinery is set up, Burmah may soon be able to add a new and valuable product to her list of exports. The Irrawaddy Valley Railway passes within a few miles of these wild olive groves, so that every facility can be had for bringing the fruit or the oil to Rangoon. Townsend tells us that the olive is indigenous to China, whence it was imported to Europe so early as 1771.

In Mr. Benson's report for the year 1877-78 of the Agricultural School at Sydapet, the cost of the institution is stated as follows:—

		Rs.	A.	P.
Ordinary charges.	Lecture fees, master's salaries and wages of establishment	8 791	5	9
	Stipends and scholarships to students ...	3,[illegible]00	0	0
	Contingent expenses	1,652	15	5
		14,017	5	2
Extraordinary expenses, including the provision of quarters for students		5,868	14	1
	Total ...	19,916	3	3

In November last Mr. Benson wrote to the Board of Revenue that as the Government have issued orders for the admission of a fresh class of students, the cost during the coming year will be increased: "I estimate, as far as ignorance of the intentions of Government will allow, that the ordinary expenses of the college will be about Rs. 20,500. The cost of conducting the institution in future will depend on the adoption or otherwise of the recommendation of the Board to appoint special Professors of Chemistry and Natural History. If also a scheme for the provision of elementary agricultural instruction in the districts, be developed, it will be possible, when it is in work, to reduce the length of the present curriculum of the College here, which has been designed to be the Central Institution for the whole Presidency, from three years to two." The Board in forwarding the above to Government have pointed out that their proposal was not to constitute two additional professorships, but to procure two qualified agriculturists to take charge of the district farms, employing them as lecturers in any subject which they might be competent to teach during their stay at Sydapet, whilst learning their duties. As the School of Agriculture is likely to become a permanent institution, the Board of Revenue have asked the Superintendent to submit year by year a budget estimate in regular form.

In reply to an enquiry from Mr. Benson, regarding the number of stipendiary studentships and scholarships which it is intended to offer to the class about to be taken in, the Madras Government observe that it was never intended to maintain the number of stipendiary studentships after the first class at twenty-four, and no reference at all to the subject appears to have been made in the prospectus issued in September last inviting a fresh class. At the same time the students now admitted may with reason have anticipated that some such assistance would be afforded; and the number for this class at all events will be fixed at fifteen, but the stipends will be slightly reduced and be Rs. 10 for the first six months, Rs. 12 for the second year of training, and Rs. 15 during the remaining nine months, *i.e.*, until the close of the final session. The scholarships will remain at their present amount, but like the stipends will not be paid after the course of instruction is concluded. The cost of these benefits for the entire period of training will thus be as follows:—

15	Stipends at Rs.	10 each, for	6 months	...	Rs.	900
15	" " "	12 " "	12 "	...	"	2,160
15	" " "	15 " "	9 "	...	"	2,025
3	Scholarships " "	10 " "	21 "	...	"	630
			Total	...	Rs.	5,715

The Government gather that the funds likely to be at the disposal of Government for agricultural purposes will bear these charges, but it must be borne in mind that when the full number of three classes is admitted, the charges for lectures will grow materially.

We quoted a statement from the *Brewer's Guardian* in our last, that maize has been successfully malted, and we are now told that not only maize but paddy, has been successfully malted at the Arvenghaut brewery. The difficulty of procuring barley on the hills is very great. When the Government insisted upon barley malt alone being used in the manufacture of Neilgherry beer, they overlooked the fact that the produce of barley on the hills is insignificant, and much of this small home growth is not accessible to the brewer, because the bucrgher cultivator consumes it himself. However, the restriction to barley malt has been withdrawn. Maize grows remarkably well in all parts of the hills, the elevation of which is not over 6,000 feet. Some of the cobs produced at Coonoor from American seed are said to have been 'superb.'

The difference that aspect and climatic influences exercise upon agricultural and horticultural produce is powerfully exemplified in the appearance, at this time of year, of the orchards of Messrs. Misquith and Frend at Ootacamund. These gardens are only two miles apart as the crow flies; the former has a southern aspect, and is at present rapidly maturing its fruit, while the latter with a northern aspect is wintering, and there is but the faintest semblance of the coming blossom. Mr. Misquith's fruit comes in about March and continues till May, when Mr. Frend's is only just beginning to ripen. Both gardens are about the same elevation. Mr. Misquith's experiences the greater share of the north-east monsoon, while Mr. Frend's gets the worst of the south-west.

Mr. Maclean, the Collector of Customs, in his report on the trade of Calcutta for the last official year, attempts to explain the great increase which has recently occurred in the trade in myrabolams: "The tanning trade usually consumes a considerable quantity of oak bark and acorn-cups from the Baltic. The derangement of Russian trade in consequence of the war, led probably to this supply not being available, and therefore consumers supplied themselves with myrabolams from India, where the crop was large." The explanation seems satisfactory on the face, but the fact is that the only effect of the war on the Russian export trade, was to divert the exports from the Black Sea to the Baltic whence there was a much larger trade than usual, while the war lasted. The real cause of the sudden increase in a trade, which has for some time been rising in importance, would appear rather to be the interruption in the supply of valonia and of galls (valonia being the acorn-cups of *Quercus Ægilops*) from Turkey and the Levant. These articles are largely used in France and in England for dyeing, tanning, and making ink, and the source of supply is the coasts of the Levant. Myrabolams will not improbably become a staple article in Indian trade. They are the fruit of certain kinds of terminalia, abounding in the Central Provinces, and parts of Madras and Bombay. When the railway is open from Nagpore to Chuttisgurh, there will be a great development of the trade, for the forests of those tracts produce a practically inexhaustible supply. The country is at present almost inaccessible.

An Agricultural Meeting and Cattle Fair will be held at Songarh, Kattywar, on 13th, 14th and 15th of this month. The subject we are told, has been taken up warmly by the chiefs and people of the neighbourhood, and also by many influential outsiders. There is every reason, therefore, to hope that the success of the Songarh meeting will even exceed that of the previous similar undertakings of Major H. L. Nutt, President of the Committee at Wudhwan and Toondla. We believe it is intended to make the coming Agricultural Meeting a thoroughly practical gathering and not a mere *tamasha*. To this end there will not only be ploughing matches, but suitable lectures are to be delivered. The class for poultry is a new feature in these exhibitions. Seeing how largely the domestic fowl is made use of in this country, and how poor the quality it is perhaps a matter of surprise that efforts to improve the breed, such as Major Nutt now proposes to make, have not been made before.

It is understood that Mr. Croft, the Director of Public Instruction, has his attention directed to the provision of Agricultural Schools in Bengal. Bombay has moved in advance of Bengal in this matter, but Sir Ashley Eden's rule will be signalized we hope, by the commencement of agricultural, as well as technical, education in those provinces. But for the unfortunate year 1873, Sir George Campbell would in all likelihood have had one or two Agricultural Colleges opened in 1874. If the local Government has any project of the kind under consideration, it could hardly do better, we think, than do as Sir Richard Temple did, write to Mr. Robertson of Madras to visit us for a month or two, that the Director of Public Instruction and the Secretariat may consult with him, as to the steps to be taken to initiate the experiment. Mr. Hurry Mohun Mookerjee submitted a scheme for the formation of agricultural classes in the existing Bengal Schools a month or two ago to the Director, but what has come of it we have not heard. Mr. Mookerjee's scheme is a very modest one, and might be submitted perhaps for Mr. Robertson's opinion. Mr. Mookerjee is, we believe, both a practical and scientific agriculturist,—perhaps the only one in Bengal.

The representative of the Republic of Guatemala at Paris has been endeavouring to introduce into the Old World, some of the less known natural products of the New; and among them he specially recommends a species of sage (*salvia chio*), which is said to be highly appreciated for its medicinal qualities, as well as for its aromatic flavour, among the inhabitants of Guatemala, where it is known as "chave." It is an annual plant growing in temperate districts, and flourishing, without requiring any attention, by the roadway or on the edges of ponds and pools of water. Its chief characteristic is in the abundance of seed which it produces, which affords a material for making a very refreshing non-intoxicating beverage. The seeds are exceedingly mucilaginous, and when mixed with water, the fluid is easily extracted, forming a delicious liquid which is much sought after as a popular drink, especially during very hot weather. The seeds are valuable also, as producing a quantity of clear, and almost colourless, oil, which dries very rapidly, and which, it is suggested, would be useful for the mixing of oil-colours. Little or no attention, however, is paid to the cultivation of the plant, or to the extraction of the juices and oils which are yielded by its seeds. As it is readily propagated from seed, there should be no difficulty in testing the practicability of its growth in this country.

What has become of Dr. Helfer's model plantation at Mergui? He and his wife some years after the first Burmese war made a tour through the Southern portion of British Burmah, Dr. Helfer having been commissioned by the Government to explore and report upon the newly acquired territory. In these reports, a translation of which has been recently published, he speaks highly of the natural resources of the province. He was the first who discovered coal on the banks of a tributary of the Tenasserim, and loadstone at a place near the Salween river, believed by the Karens to be haunted by gnomes who permit no man who intrudes upon its sacred summit to leave it. No part of the book surpasses in interest the account of Dr. Helfer's model plantation at Mergui which Madame Helfer strove with characteristic spirit by the help of her brother to keep up after her husband's death. The Board of Directors however in accordance with the spirit of those days refused to give a grant of the land, although it was strongly urged by Lord Auckland, the then Governor-General, and the plantation had to be given up by Madame Helfer, who returned to Europe.

The fact is now pretty well established that should grapes fail, we have an excellent substitute in oranges for the manufacture of wine. A French paper states that four different kinds of wines have already been obtained from the latter fruit, one called imperial, and a dry wine from the fruits produced in January; mandarin from those of April, and a sparkling wine, by a special process, possessing a little more than 12 per cent. of alcohol. The fruit is made use of before it is fully ripe. Growing so plentifully as the orange does in parts of India, Nagpore and Sylhet for instance, we may hope to see good wine produced in this country before many years have passed.

The results of the analyses of some of the Ceylon soils made by Mr. Hughes have been published, including those of Kahagalla, Wiharagalla and Kalupalani in the Haputale district, and a number of estates in the Dimbula district. In the case of the Haputale soils some disappointment is felt by the planters in that district at the results of the analyses, and at Mr. Hughes' remarks thereon, no cause for the dying out of coffee being given, but Mr. E. G. Harding writes to the *Ceylon Observer*, suggesting that the dying of trees even in such rich soils as those in Haputale may be accounted for by their roots coming in contact with some poisonous substance, such as peroxide of iron, and that deep draining may prove effectual as a cure. The results of the analyses of the Dimbula soils have also given surprise, but of an agreeable nature, for they turn out to be some of the richest in Ceylon.

From statistics before us, we find that the acreage in Bengal under jute this season exceeds the amount last year in the district of Buckergunge by 40,000 acres, in Furreedpore by 41,000 acres, in Rajshaye by 27,000 acres, and elsewhere by 10,000 acres; whilst in Pubna and two or three other districts on the Pudda river, there has been a decrease of 37,000 acres owing to want of rain, and the transference of land hitherto employed for jute to the production of cereals.

Mr. R. Hember, of Queen Charlton, Keynsham, near Bristol writes of some important experiments in a letter addressed to Mr. Eastmead, of the Crowle Charring and Condensing Company, on the nature and value of charcoal as a basis for manures:—"I am fully satisfied that as a basis for manure charcoal will be greatly appreciated when it is more generally known. I am a great believer in charcoal myself, having taken a hint when quite a lad working upon my father's farm at "stifle burning." I noticed how much better the ashes were when burnt black, or only charred, than those that were over burnt or burnt red. Those black ashes saturated with the runnings of a dung heap or stable used to be a very favourite garden manure, the results being so much better when the 'burnbake,' as we used to call it, was used, than when the liquid alone was used. This gave me a great idea of black burn-bake, which I considered a species of charcoal; and for eighteen years I made artificial manures for my own use, and the last five years for sale to customers. I have used charcoal with the very best result. I could relate many surprising results from mixing charcoal with artificial manures, and you will find you have much to learn yet of the good effects of charcoal. I am trying experiments every season on my farm, which is 300 acres, so that I have an opportunity of judging of its effects upon the different crops, and I carefully note its effects upon my customers' crops. Most of them tell me that they never saw such results from any manure, and that they could not believe that any manure whatever, could make such a difference. I attribute my success entirely to a suitable admixture of charcoal. It is a great cleanser and storer of ammonia, and there is more in it than any of us know of yet. Many objectionable plants will be found to disappear entirely by a few applications. It will quickly remove moss and things of that kind; and, from appearance, I believe it to be proof against smut and blight in corn crops. I do not sow or prepare seed corn in any way, but sow it simply as it is, and I do not see any smut or

blight of any kind. The manure seems to have a great cleansing and invigorating effect."

The *Rangoon Gazette* says that the Toungoo Missionaries are about to try their hand at sheep farming among the Karens. If we are not mistaken they tried the experiment some years ago. The Government made over a number of sheep to one of the missionaries for distribution amoung the Karen villagers, but the result does not appear to have been successful. Sir Ashley Eden when Chief Commissioner took great interest in the attempt to introduce sheep breeding in the Province. Shepherds were sent over from Bengal and farms were established in the Prome and Thayetmyo districts, but the project failed, the farms were broken up, and the sheep made over to the villagers; but most of the sheep died. No doubt, sheep breeding would succeed in certain places in Burmah under competent European management.

From a recent issue of the *Journal of Applied Science*, we obtain some interesting particulars of the cultivation and manufacture of indigo in Salvador. This, the most important product of the Republic, is still classed in Europe under the name of Guatemala indigo. In the country it is usually called *jiquilite*. It grows anywhere, but it is generally sown in ground prepared beforehand. The soil, according to its geological composition, produces different results in the indigo. Thus, at the foot of the volcano of San Savaldor, half a pound of dye is sometimes obtained per load of leaf; at Santa Barbar, the property of General Gonzalez, and at Santa Cruz, which is situated at some distance from the sea, thirteen to fourteen ounces are obtained. Nearly all Salvador is covered with jiquilite, forming fields of verdure, and furnishing rich products to its agricultural industry. The localities where the jiquilite is grown are called *manchones*. The workmen (*sacateros*) cut the plant with a small sickle, and form it into sheaves of fifty to sixty pounds; four of these latter form a load of eight to ten arrobas. The jiquilite is thrown into vats called *obraics*. Each pile of twenty-five loads requires two vats, and the maceration lasts from twelve to seventeen hours, according to the temperature and composition of the water. When the liquid is in a state of fermentation, the colouring matter is drawn off into another vat, where it is beaten by means of wooden wheels, and then the dye is precipitated by the sap contained in the bark of the *Tihuilate* (*Yonidium*) of the Platanillo (*Myrosma Indica*, or of the Cuaja tinta; these plants have no acid reaction. When once the dye is precipitated, it is allowed to settle during the night, and the following day it is boiled, filtered, pressed, and lastly dried in the sun. Every bale or suron contains 150 pounds. The different grades of indigo are specified by numbers. From four to six, ordinary; seven to nine, fine or superior. The first numbers correspond with what are called "Cortes" and the second "Sobresalientes." Salvador generally produces nearly 2,400,000 pounds. With better apparatus the grades would be superior and the product more abundant. San Salvador exports annually 14,000 to 15,000 surons of 150 pounds each, which represent an approximate value of 1,721,378 piastres or dollars. The superior indigo is sold in the fairs of the country at about eight reals the pound; the lower grades vary between three and five reals the pound. The produce of the superior grades costs on an average $1·25 the pound, on board steamer; numbers seven and eight, one piastre the pound; and number six, seventy-five centavos (3*s.*) per pound. In the European markets, the prices vary according to the crop of the preceding year, and the larger or smaller production of indigo in India, with which it has to compete.

The *Behar Herald* says "the Sarun Irrigation scheme introduced during the last year is of a somewhat novel financial character, It is based on a local guarantee of the interest on the capital outlay. It consists of a canal by which water from the Gunduck will be thrown into the principal water-courses of the district, from whence it will be distributed at the cost of the people themselves for irrigation and manufacturing purposes. The estimated cost is five lakhs, 4½ per cent. on which has been guaranteed by a few of the principal planters and zemindars, the Government remaining responsible for the cost of maintenance, and recouping itself from the proceeds of the sale of all surplus water for irrigation, the guarantors having priority of right to a supply. Some progress was made with some of the supply-cuts during the year, and it is hoped that the works will be finished before the rains of 1879."

The Rev. L. St. Cyr of Dindigul has for many years maintained a very useful establishment, an Agricultural Orphanage, for native children at Dindigul. The orphanage buildings, which are intended for the accommodation of 50 children only, were found insufficient for the increased numbers maintained during the famine year, and had to be enlarged at a cost of about Rs. 1,000. The cost of the buildings and the increased cost of maintaining so many children press heavily upon the slender resources of Mr. St. Cyr; he therefore appeals to Government for a grant-in-aid of the building outlay. The Governor in Council has replied, that the curtailment of famine expenditure places it beyond his power now to make any further grant of the character of that applied for by Mr. St. Cyr.

A contemporary draws attention to a new value for geraniums. In South Africa, we are told, the geranium has the reputation of being proof against snakes, which it is said, avoid the plant as though it were poisonous. We are reminded, that though the flowers of the geranium are scentless, the leaves contain a quantity of volatile oil with more or less pungent odours. A missionary in South Africa has surrounded his house with a cordon of geraniums, with the result that it is never visited by these unwelcome intruders. To the Kaffirs is attributed the discovery of this property in the geranium. It is suggested that this volatile oil might prove an antidote to snake poison.

There appears to be some probability of a tobacco monopoly being introduced at no distant date by the Russian Government, in imitation of her Western neighbour. A form of inquiry, containing twenty-nine questions on the cultivation, consumption, taxation and manufacture of the plant in various parts of the Empire, has been sent from head-quarters to the authorities in the various governments, and it probably depends on the nature of the information supplied in reply whether the State will decide to monopolize this industry for the future. The uncertainty prevailing on this point is causing some anxiety among the tobacco farmers of the south, and especially in Little Russia, Bessarabia, and some of the governments of the Volga, where the chief crops are grown. The total annual tobacco crop of Russia, including the small supplies from Siberia and the Caucasus, averages about 3,102,000 *pud*, and its money value may be estimated at 6,250,000 roubles.

Among the useful substances obtained without culture in China are various kinds of mushrooms, such as *Boletus edulis*, *Agaricus edulis*, and species of Polyporus, &c., gathered on trees, and which are employed as food, also the flowers of *Hemerocallis graminea*, which, when dried, constitutes one of the choicest delicacies of the Chinese kitchen. It is largely exported from the province of Shantung. Various tinctorial plants also grow wild, such as *Rhamnus utilis*, and *R. chlorophorus*, which yield the famous green dye of China. The bunches of flowers of *Sophora Japonica*, a tree common in the north, are collected to dye yellow. The roots of *Rubia Munjista* furnish the red madder, whilst in the south the bark of *Pterocarpus flavus* gives a yellow colour. In the north a black is obtained from the acorn cups of the oak; in the south they collect for the same purpose the gall nuts of *Rhus semialata*.

Nawab Abdool Gunny's "Agricultural Exhibition" at Dacca appears from an account published in the local paper to have been very successful as a *fête*, but a failure as an Agricultural Show.

There are 47,755 acres under tobacco in the Central Provinces, the cultivation being most confined to the Raipur district; and everywhere it is considered of an inferior quality as compared with other Indian varieties, which are largely imported. Sugarcane (98,406 acres) is also local in character, one quarter of the cultivation being in the Raipur district; Sambalpur, Betul and Bhandara having each about 10,000 acres, and there being only smaller areas elsewhere. The produce in its unclarified state is generally consumed, and it is nowhere clarified in these provinces, all refined sugar being imported from either Benares or Bombay.

Fibres (28,894 acres) are mainly of the two or three kinds of "san," the ambari (*Hibiscus cannabinus*), and the *Crotalaria juncea* being mostly raised. They are used in the manufacture of ropes and bagging, but little is exported.

COMMUNICATED AND SELECTED.

REPORT ON BAMBOO; ITS CULTIVATION AND CROPPING.

By Mr. Robert Thomson, *late Superintendent, Botanic Gardens Jamaica, West Indies.*

At your request on my return to Jamaica last spring, I continued to devote particular attention to the subject of bamboo production for paper-making, and I am glad to report with encouraging results.

While thus endeavouring to throw further light on my previous convictions, I had occasion to visit, officially, certain extensive districts of the Island in which bamboo largely abounds, and in which it is regarded as an irrepressible weed, very frequently even to the exclusion of more desirable uncultivated products.

Amongst other points of enquiry, I was anxious to ascertain the condition or degree of development in which the bamboo is best fitted for cropping to answer your purposes, and this I think I have satisfactorily settled. The point is of some interest, as much misconception (*vide* published reports) prevails as to the proper stage of growth at which the shoots may be most economically turned to account, and whereby the maximum production of those shoots adapted for paper-making is insured; hence a largely increased return from a given area as compared with the yield from crude, half-grown stems, and by the same mode of treatment the reproductive powers of the plant itself are invigorated.

My convictions under this head were formed at the time I visited Ford Works and witnessed your experiments of converting raw bamboo into "Paper Stock," coupled with the frequent discussions with you on the subject.

The condition in which the stems of this bamboo (*Bambusa vulgaris*) are fitted for cropping is readily determined by the yellowish sheaths that invest the upper portions of the stems in conjunction with the first expansion of some normal leaves which burst at the summit of the shoot. The appearance of the foliage in young, vigorous stems is immediately followed by the precipitation or shedding of these sheaths, which up to this period characterised the young stems. The average height of these shoots, at this stage of growth, after abundant rain, ranges from 30 to 40 feet, and as the apices of the shoots, to the extent of a few feet, are quite succulent, it is necessary to remove this portion.

The stems thus divested of the tops should be separated *into two, possibly three, classes of material,—i.e.*, the ligneous portion towards the base to form a distinct quality from the less indurated upper portions, which produce, as you showed me, finer and more delicate fibre, and require less active chemical treatment for their conversion into "Paper Stock."

In consequence of the unusually prolonged rainy (May) season, which this year began in June, heavy falls of rain having been experienced in the wetter districts of the Island for months, with brief intermissions of sunshine, bamboo flourished most exuberantly.

In the localities in which this gigantic grass largely abounds—*invariably in the most humid localities*—during months of August and September, an abundant stock of young shoots was for the most part ready for cropping. I traversed hundreds of acres with an equally prolific supply, which could be continuously cropped for several months in succession.

For commercial purposes, that is to utilise the stems in the condition you have found most suitable for paper-making material, bamboo has nowhere been subjected to systematic cultural treatment. Data are therefore wanting in order to test its productive power as regards the yield per acre per annum and the proportionate extent to which continuous cropping may be resorted to.

The facts which I will now relate have a direct bearing on these points, points which exemplify the ability of the plant to reproduce large and regular crops—*a view of the question not hitherto admitted by various writers.*

A few years ago, some 1,300 tons of bamboo were exported from Port Morant, Jamaica, to the United States for paper-making. All the material was obtained within a radius of a few miles; the gentleman who had the contract for supplying it for shipment received £1 per ton for the material delivered at the port. The usual price paid for felling and splitting bamboo is two shillings per cord, which, when dried, weighs about 700lbs., say about six shillings per ton, thus the cutting, crushing, pressing and carrying to the port were all performed, including the acquisition of the raw material, for £1 per ton.

The kind of bamboo that was thus utilised was *matured* stems, and they were felled *en masse* from every available clump. I was informed by the contractor that he commonly cut down clumps from the same stools twice in three years.

Also in another locality, some miles distant, hundreds of tons were prepared for shipment; in the latter locality (four years after the stems were felled) I carefully examined many of the stools from which the hundreds of tons were taken, and found the lofty and vigorous stems so completely reproduced that it was impossible to surmise that any distinction existed between them, as regards the rank luxuriance and towering height of these stems, and the surrounding groves which had not been touched.

Numerically, however, there was a material difference between the stems produced by the four-year-old shoots, and those of greater age, the oldest clumps possessing several times more stems.

Two months ago, owing to the preceding period of excessive rain-fall, as previously referred to, there was a large stock of young shoots on the clumps which had been cut down four years previously, each of the four-year-old clumps, with an average number of 40 mature stems, possessed from 8 to 10 stems suitable for paper-making material. These young stems were the result of one season's growth, and there are two seasons in the year.

The average area of each renewed clump was 576 superficial feet, say 75 clumps to the acre; each stem fit for cutting weighs fully 20 pounds.

The 40 mature stems had been produced by continuous successional sprouting, and for all practical purposes may be assumed as having grown at the rate of 10 shoots per annum during the four years.

These clumps had, of course, experienced a treatment quite different from the system which would ensure large and continuous cropping, namely—coppicing, it being understood that coppicing does not imply cutting down the *whole of the stems* or shoots to a short growth (of say two to three feet), but that such shoots only as are selected for cropping shall be cut at this height from the ground, as a certain number of stems must always be left, say one-fourth, to attain full development and to maintain the root action or vegetative functions of the plant, such stems being available at subsequent cropping for fuel.

In a previous communication, I directed attention to the advantages that would accrue from the adoption of a systematic course of cultivation and irrigation on land specially selected for the purpose. Under such circumstances there can be no doubt that the yield of shoots, as compared with the returns from uncultivated stock, would be at least doubled per annum. Thus, the precarious seasons, and the unmethodical course of procedure, implied by a chance source of supply, existing under any condition (to say nothing of irregularity of selection and extra cost of collection) would be obviated.

I was also of opinion that the St Catherine Plain, near Spanish Town, which has been rendered irrigable by the Government for agricultural purposes, would be well adapted for the establishment of bamboo plantations. On further enquiry however, it would appear that these lands are already specially reserved for other objects of culture, and consequently would be more expensive and less easily acquired than lands in most other parts of the Island.

In this connection it may be observed that rivers for irrigation purposes are available in many other parts of the Island, and if the Parish of St. Thomas was selected for the establishment of plantations, there is the advantage of procuring many hundreds of tons of young shoots annually from the existing stock, which can be cut, pressed, baled, and delivered at port, after making every allowance, for £2 per ton.

It would be a pity, however, to export the raw material in this state, inasmuch as great economy results from the conversion of it into paper-stock as you propose.

Well-managed plantations of bamboo will undoubtedly yield annual returns of young stems of from 5 to 10 tons per acre *taken as dry*, available for paper-stock.

14th November, 1878. ROBERT THOMSON.

The Madras Government will make a good thing out of their cinchona plantations. The net profit on the bark sold in 1877-8 was no less than Rs. 2,88,980. The crop taken during the year amounted to 138,808¼lbs. of which 132,951½ lbs. were shipped to England, and 5,330 lbs. were supplied to the Madras and Bombay Medical Departments. The supply of moss is becoming a source of anxiety. Several extensive private cinchona plantations have been opened out adjacent to the Government plantations, and when these estates begin to yield crop, the supply of moss will certainly fail, unless a substitute is found, or coppicing is resorted to more than hitherto. The difficulty in procuring labour is also yearly increasing.

INDIAN AGRICULTURE AND MODEL FARMS.

THERE can be but little doubt that the prevention of Indian Famines depends, in a great measure, upon the improvement of the system of agriculture pursued in the country. This system has sometimes been described, in the words of Liebig, as the "Spoliation system of agriculture." It is said that the soil is not deeply ploughed, and that there is incessant cropping without returning anything to it. Bad culture, it is argued, has an exhaustive effect on the soil. Those who hold this view, would make us believe that the increasing frequency and entireness of failure of food-crops of late years on the occurrence of drought, show that the soil throughout the country is becoming exhausted. It is not our present purpose to determine whether the soil is actually becoming exhausted or to consider the cause of that exhaustion. We, however, think that nobody will have the hardihood to deny that the method of tillage pursued by the Indian cultivator is susceptible of considerable improvement. The question is, how this improvement is to be effected? The Governor-General in Council, in defining the duties of the Famine Commission now sitting at Simla, observes :—"It is apparent that the improvement of the practical agriculture of such a population as cultivates the soil of India is a task of great difficulty. Of late years, some attempts have been made to promote this object. Their success, however, has been questionable, and measures, giving an effectual stimulus to this class of improvement, would be of the greatest value to the country."

The attempts referred to here, as having been made to promote the improvement of Indian Agriculture, are, no doubt, the establishment of Model or Experimental Farms in various parts of the country. These farms have now been in operation for some years; and we should see what results they have so far achieved. When the Imperial Department of Agriculture, Revenue, and Commerce was organised by Lord Mayo in 1871, it was said that the new Department would greatly promote the introduction of a better method of tillage by the establishment of Model Farms. These farms were to accomplish wonders. Mr. Allan Hume, who was selected to be the first Secretary to the new Department, clearly explained his views on the subject. He wrote:—

"Briefly, what I contemplate is at least one large Government Model Farm in every district of the country where all existing staples shall be grown at first in the most approved native fashion, and year by year on improved and ever-improving systems, and from seeds year by year improved by selection, and, where necessary, by interchange with other similar farms, where cattle, sheep, poultry-breeding shall be cautiously, but perseveringly, carried on, and where locally unknown staples and breeds should be gradually introduced, acclimatized, and popularized. The whole of these farms should be closely connected with each other. Their supervisors encouraged not only to vie with each other in results, but to visit and communicate with each other in the freest manner possible. Liberal prizes should be offered for those supervisors who make their farms pay best, and, besides these, provincial exhibitions should be held with the numerous prizes for excellence of produce, whether agricultural or animal, equally open to the farms and to the agricultural population generally. A special Agricultural Journal should be started for the record of all done at these farms, all experiments, all failures, all successes, so that all might know what all were doing, and so profit mutually by each other's experience."

Directly it became, on the whole, an acknowledged fact amongst the people of any district (and the people have eyes as well as we have, and can appreciate good crops and better methods of tillage just as well as we can when we *see* them) that their Model Farm was really growing better crops, or growing crops similar to their own, cheaper, or breeding better stock, or turning out better seed than they were themselves able to do; sons of well-to-do cultivators, peasant-proprietors, and the like, who concern themselves personally with practical agriculture, should be allowed and invited to reside at the farm and familiarize themselves with the system there followed, and the methods of caring for the stock there bred. All that showed capacity and intelligence, and deserved it, should be furnished at cost price, with improved seed or stock to start with on their own lands.

Each farm should, in fact, become at once a practical school of agriculture, and a source of supply of improved 'material,' whether vegetable or animal.

This was a grand scheme; and its ambitious author, Mr. Allan Hume, took care to assure the public that it was "not an Utopian idea." The project, he contended, if carried out, would even directly and fully repay its own expenses. Now, after the lapse of seven years, the public is in a position to judge of the results achieved by the Model Farms. We have no hesitation whatever in saying that these farms have proved costly failures. So far, they have not exerted the slightest influence on the improvement of native agriculture; and the reason is obvious. Lord Mayo spoke with uncommon good sense when he remarked that the establishment of Experimental Farms would be altogether useless, if attempts were made to teach native cultivators either such things as they already knew, or such improved systems of agriculture as they could not afford to practise. Mr. Allan Hume is also quite right when he says that the people of this country have eyes, and that they can appreciate good crops and better methods of tillage as well as Englishmen do, when they *see* them. The Indian cultivator may be taunted with unwillingness to depart from the ways of his fathers. He is, however, a shrewd observer and understands his interests thoroughly. The Model Farms may have shown him that better crops might be raised by the adoption of superior methods of tillage. He might have even learnt how to do likewise. But what good is the poor fellow to derive from his knowledge? He feels "that he a poor man, cannot afford to grow crops as the *Sirkar* does." For the improvement of Indian agriculture what is wanted is not knowledge of improved methods of husbandry, but capital. The ryot knows, as well as a European agriculturist, that deep ploughing and adequate manuring would lead to the production of better crops. But he cannot afford to reduce his knowledge to practice. He has no money wherewith to provide himself with improved agricultural implements and a superior class of cattle; he must burn the manurial substances, because the purchase of firewood is beyond his means. So long as *the Indian peasantry remain in their present abjectly and hopelessly poor condition, to expect any improvement in Indian agriculture,* would be to expect an impossibility. Experience has demonstrated the utter uselessness of Model Farms; they might be closed to-morrow without any injury to public interests. If the Government is really anxious to improve Indian agriculture, it should begin with rescuing the ryot from the clutches of the village-money-lender, by the establishment of Agricultural Banks, such as we have frequently advocated in these columns.—*Indian Tribune.*

SOME FACTS ABOUT LIME.

SEVERAL correspondents ask for information concerning the use of lime on land, and all of them contain evidence of several commonly accepted, but false, theories. First, lime is not plant-food; or rather it is so common in most soils, and incidentally comprises so large a portion of many fertilizers, that its application as plant-food is unnecessary. We have not seen a soil analysis from which this constituent was missing, and there is nearly always considerable of it present in available form; all true superphosphates are composed of one-fourth part or more of lime, and it is prominent in Peruvian and fish guano, in nearly or quite all manufactured fertilizers, as well as in barn-yard manure.

Lime, however, has an important effect aside from its action as plant-food. Freshly burned lime (known as "caustic lime" and "quicklime") has a strong affinity for carbonic acid, so that when it and organic matter (which always contains a large proportion of carbonic acid) are mixed together, the lime and carbonic acid unite, promoting the decomposition of the organic matter. Newly "slaked lime"—which is lime united with water—has an effect similar to quicklime, though slower, and hence is better for farm use. Fresh, undecomposed organic substances, especially dung, contain the most valuable ingredient of plant-food, nitrogen, in its simple form; but it is very soon changed into ammonia, which in turn unites at once with carbonic acid. Then when lime is brought in contact with the mass, it at once combines with the carbonic acid, and the valuable ammonia escapes and is lost. When however, the lime is applied before the ammonia is formed, the nitrogen is oxydized to nitric acid, which unites with the lime to produce nitrate of lime, and the nitrogen is saved. Therefore, lime may be used in stables and house privies, or in composting carcasses of dead animals, to advantage; but if mixed with manure a day or two old, the result is a loss of valuable material. The above also shows why, when lime is put into a compost, it has such beneficial action in hastening decomposition, and why it is necessary to use plenty of fresh earth to absorb the escaping ammonia.

Free acids, and those in easily decomposible substances, are also readily taken up by lime, and many injurious compounds, as of iron in wet lands, are rendered harmless. In some soils insoluble silicates of potash, &c., accumulate; but the action of lime will break up these combinations and set the potash free for use as plant-food.

The above statements show that the main action of lime in the soil is in making available, plant-food what was before unavailable. Therefore, while it may increase the crop-yield of poor land, it will tend to bring about its early exhaustion, unless plant-food is added. In heavy clay soils, the above mentioned chemical reaction of lime, destroy their tenacity and makes them friable and porous. Soils containing a large proportion of organic matter are benefited by its application. Wet lands are less benefited by lime than the same when drained, on account of the water. Light soils are improved by it when accompanied by a liberal application of muck or other organic matter; clays should also have the same treatment. As the best effects of lime are not apparent until the second year, it is best to apply it early in the fall; then, if the land is not rich enough, manure or other fertilizer put on the following spring will help to produce a good crop, other conditions being equal. The amount used is from 10 to 50 bushels per acre, according to the circumstances, the condition of the soil, &c.

THE SYDAPET FARM.

TO an Englishman who visited the Government Farm to witness the ploughing match ample material for ridicule, and ample opportunity for cavilling at the whole system of agricultural education were presented. If he had ever seen an English ploughing match he could hardly avoid making a mental contrast in which the dress, the manner, the implement and the performance of the competitor would form important features. The contrast would not, we fear be complimentary to the Sydapet Farm. It is not however from any wish to make the institution ridiculous, nor in any captious spirit that we desire to call attention to some of these features, not as professors of agriculture, but simply from the point of view of an outsider. On entering the field the spectator is probably pleased to see numbers of such a respectable class as that to which the student competitors apparently belong, condescending to drive a plough. It is gratifying to learn that such manual labor is not regarded by them as an indignity only fit to be performed by menial servants: but the feeling of gratification is cooled, when note is taken of the dress in which they equip themselves for their work. The English laborer and the Madras ryot alike understand how to suit their costume to their taste. Each in his way dresses himself in a manner most fitting to the circumstances, and least calculated to impede his exertions—not so the student of the Government Farm, Parsee or Hindu. Anything more ridiculous and incongruous than their costume under the circumstances can hardly be conceived. One competitor was clad in the ordinary dress of a Madras servant slippers and all. Another had boots with high heels more fitted for the pavement than the field. All, if we remember right, had on white clothing; none had either bare feet or the flat broad soled boot, which if a man is to be shod at all is the only sort of shoe in which he can move about readily over rough ground. Shod as they were, their gait was naturally unsteady, and the only wonder is that there were no dislocated ancles. We should have thought that Mr. Robertson having overcome the prejudice against labor, which is so common in this country, so far as to induce his pupils to handle a plough, might have gone a step further and persuaded them to cast aside the ornamental parts of tuari and appear in the field either in the simple costume of a ryot or in some other suitable dress. It looks as if the agricultural student, like so many other people who have given up the substance of an idea in practice, were determined to hold on to the fringe, so that they should still be distinguished as amateurs, and not confronted with the ordinary members of the ploughing class. The matter of dress serves to point an observation which we wish to make generally, with regard to the whole institution as exhibited at the ploughing match. What strikes an uninitiated observer, at least, is that the students and ryots want example more than precept: they need to see good work done in a good way with good implements. We would ask of Mr. Robertson, whether he or any of his subordinates has ever put hand to plough and practically illustrated to them, how a farm ought to be turned over. We doubt not that there has been plenty of lecturing, but we doubt much whether there has been any practical illustration. It strikes us that it would have been a useful feature in the ploughing match, if alongside of the struggling tottering students there had been a really competent ploughman, or, at least, if alongside of the waving furrows executed by them, there had been some good straight deep furrows ploughed out as a model. Nothing is more useful in all sorts of training, than to establish a good standard whereby performances can be measured. At the Government Farm there was no standard by which either spectators or labourers could guage the work done. Leaving the men, we have a few observations to make on the cattle and the implements used. Two things are perfectly clear with regard to them, that there is no comparison between the European and the native plough for efficiency, and that the former is not suited for general use in this country. For the most part the students worked with European, chiefly we believe Swedish, ploughs and of course the results they produced were far better than those produced by the native implement. But those results would not have been produced except under the favourable circumstances in which they were placed. The bullocks of the Government Farm are not fair representatives of the class bullock, they are naturally above the average in every respect, and therefore because they could draw European ploughs it does not follow that the ordinary cattle could. Clearly the ordinary pair of bullocks would succumb under the strain: but even the superior animals do not prove very efficient and certainly need a driver. Standing at a distance and not just over his cattle as with a native plough, the ploughman is at a great disadvantage, and unless he is armed with a goad, which would be difficult to wield, is completely at the mercy of his animals. As might have been seen at the match, they can stand still, turn round or go at a funeral pace, while the unfortunate ploughman is powerless. The native ploughman with his own implement is not exposed to such treatment, he commands the tails of his bullocks and little as his work is in the result, it is at least done at a decent pace. One or two men were working with hybrid ploughs which seemed efficient enough, and not so open to the objection of weight: but even of them it might be objected that they threw the ploughman too far back from his bullocks and therefore necessitated the presence of a driver. Of course too they are too heavy to be carried about with the facility with which the plough of the country is carried. Altogether we fear very much, that there will be no real improvement in agriculture until there is material improvement in the draught cattle. The saddle must be fitted to the wearers' back, and it is useless introducing English or Swedish implements, before animals are forthcoming which can draw them. If the Government Farm is to be efficient for good, it is we think by way of example: if the Hindu is to be dragged out of the groove in which he works and which probably dates from a time anterior to the infusion of the Aryan race, it must be done by showing him demonstratively, that better results may be produced by better means. Example, is what rather appears to be wanting at this institution; we cannot believe that we should have seen the incongruous costumes which we saw at the match, if Mr. Robertson's European subordinates were sometimes in the habit of descending into the arena, and showing in their own persons how good work ought to be done.—*Madras Athenæum.*

CARBON AS PLANT FOOD.

THE great mass of vegetable matter is composed of woody fibre (cellulose), which consists of carbon 44 per cent., oxygen 49·62 per cent., and hydrogen 6·38 per cent. Nearly one-half of the vegetable growth of our forests and fields is, therefore, organised carbon. This substance is known to us in the form of charcoal, though the diamond is pure crystallized carbon. In its uncombined form, it is not soluble in any known liquid, nor is it fusible in any heat we have been able to produce. At red heat, it combines readily with oxygen in a brisk combustion, without flame, and the product is a gas composed of 27 per cent. of carbon and 73 per cent. of oxygen, and commonly known as carbonic acid. It has a feeble acid reaction, and forms salts with alkalies. At the temperature of 60 degrees, water will dissolve and hold in solution its own measure of carbonic acid gas; but it parts with it all at a boiling heat. In this form all the carbon appropriated by plants is furnished, and it would be a very natural inference that to furnish a supply of carbonic acid would be the first care of the farmer. But this would be altogether an erroneous conclusion.

From various sources, the air is always supplied with carbonic acid in sufficient quantities to answer the demands of plant growth; but the chief interest of the farmer is to place his crops in a favourable condition to appropriate the carbon brought within its reach. An animated dispute has been carried on for several years between two schools of vegetable physiologists—the one contending that all the carbonic acid used by the plant was absorbed by the leaves, and the other holding that a portion of it was supplied by the roots, being held in solution in the water absorbed. The question, however, is one of but little practical importance, as both parties admit that plants derive all their carbon from carbonic acid, and that the decomposition of that gas takes place in the leaf.

The important matter, practically, is to understand the conditions under which vegetables appropriate carbonic acid; for this is the secret of their growth. Those conditions are chiefly two: first a healthy condition of the leaf; second, a full exposure to sunlight. The first of these is that which chiefly concerns us. Leaves absorb carbonic acid in proportion to the amount of green colouring matter they contain. This, as I have always said, depends on a supply of nitrogen in a form that the plant can use it.

Ammonia dissolved in water and absorbed by the roots is the usual form in which the supply of nitrogen is obtained. This is decomposed in the leaf by the agency of sunlight, and the nitrogen, set free, immediately enters into a new combination, and the green colouring matter is the result. But this change demands the presence of potash and phosphoric acid; in very minute quantities, indeed, but still essential. A deficiency in any one of these conditions will give a pale or yellow leaf; and every farmer knows what that means, though he may not be able to explain why it is so. But plants absorb no food, by the leaf, in the dark, and there is no chemical action in the absence of sunlight. It is true that plants grow at night; but they grow by using the material prepared in the light and by its agency.—*R. T. Brown, in the Country Gentleman's Magazine.*

THE NELAMBUR TEAK PLANTATIONS.

MANY of our readers are probably unaware that the Government possess at Nelambur, a station on the Western Coast, some forty miles inland from Calicut, a most valuable property in the shape of teak plantations. We are not in a position to write a full history of these rich plantations, but we have been enabled to gather together a few items of information that may not perhaps prove uninteresting. At any rate we think they will clearly prove that the Government has made an excellent investment in creating them, while the public is greatly benefitted by being allowed to purchase the timber produced there. We all have heard of the success of the cinchona speculation which the Government is conducting on the Neilgherries, but of the older undertaking—the teak plantations —we hear but little, although they are in our opinion almost of as vast an importance as the first mentioned. We believe the original motive for their establishment was ultimately to secure a regular supply of good teak timber for the use of the East India Company's Dockyard at Bombay; but since the time they were started, not only has the dockyard establishment dwindled to very small proportions, but the old Company itself has disappeared. The existing Government, however, are reaping the benefit of the wise forethought displayed by those who first advocated the creation of these forests, and it is not too much to say that they were indeed public benefactors. We believe they were first commenced about forty years ago under the auspices of the late Mr. Conolly, the Collector of Malabar, who was murdered by some Moplahs. It may be remembered by our older readers that the murder of the gentleman named was the immediate cause of the passing of the Moplah Act, the stringent measures provided by it having been put into force on several occasions, and so recently, if we recollect rightly, as last year. Dr. Cleghorn when chief Conservator of Forests for Madras took lively interest in the experiment, and we believe it was at his suggestion that the gentleman, who has been in charge of the plantations since 1862 was brought out to the country. This gentleman has met with but scant courtesy at the hands of Government, if judged by the success which has attended his labours and the small pay he still receives. The success which has attended the enterprise is due in a very great measure to his constant and arduous labours, and we trust he will shortly receive his due reward. The plantations at present cover an area of three thousand four hundred acres, and have cost for supervision and working charges from the year 1840 to March 1877 nearly two and a half lakhs of rupees. Of this amount, however, one lakh and twenty-four thousand rupees have been recovered by the sale of thinnings, so that the balance at present standing to the debit of the plantations is about one lakh and sixteen thousand rupees. The prospective value it is somewhat difficult to calculate and we must turn to the rate of growth to enable us to arrive at a fair estimate.—*Madras Athenæum.*

IN accordance with the instructions of Government the Conservator of Forests visited the Government teak plantations in Malabar last year, and submits full details as to their extent, cost and present condition, with his views as to their future financial prospects. Colonel Beddome's inspection was very thorough, and his scrutiny of the past and probable expenditure and receipts very searching and complete; but the result is that he anticipates "an enormous yield and very large profits." This report is specially satisfactory as hitherto he has not been sanguine as to the success of the enterprise.

The Nelambur Forest Division is divided into fifteen blocks, and, according to survey measurements, their acreage is as follows:—

				Acres.
Planted	...	...	...	... 3,435·98
Unplanted	...	...	...	... 15,433·71
			Total	... 18,869·69

The planted portion is further divided according to its anticipated yield as based on its present condition:—

				Acres.
E.G.				
Full yield	...	...	...	... 1,787·85
4/5ths	...	...	...	... 825·75
3/5ths	...	...	...	... 539·26
2/5ths	...	...	...	... 273·78
Nil	...	...	...	... 509·84
			Total	... 3,435·98

Thus on "509 acres or more than 1/7th of the whole" planted portion the growth is so poor that the Conservator thinks it safest to enter the anticipated yield as *Nil*, though he considers "there is much that might be classed as 1/5th."

The following abstract statement exhibits the charges and receipts for the whole division from 1840 to 1877-78:—

Charges.	Rs.	A.	P.	Receipts.	Rs.	A.	P.
Acquisition of land, &c..	1,00,840	7	4	Timber	1,57,798	7	2
Establishment	1,47,635	1	11	Bamboos	10,755	0	8
Charges on timber	45,114	12	6	Saplings	1,29,312	13	6
Plantation charges	1,51,896	14	6	Miscellaneous	2,535	13	1
Floating operations	31,008	3	2				
Total	4,77,395	5	11	Total	3,00,402	11	5

The Board of Revenue, having supplemented the Conservator's figures with details furnished by the Collector, calculate the total debt of the plantations, "accumulated at 4 per cent. compound interest, at Rs. 3,77,827."

To estimate the future return from the plantation it is necessary to determine the age at which the trees will arrive at maturity, the number and cubical contents per acre, and the price the timber will fetch.

Colonel Beddome believes that the trees in the plantations will grow and develope more rapidly than those in the natural forests, and as those are found to be mature at about sixty years, this may safely be taken as the age of maturity.

For the first thirty years of their life the upward growth of the trees is encouraged, but as the numbers originally planted become much thinned out, and air and light are admitted, and there is more space, this tendency is somewhat checked, and the growth in girth takes its place. Some of the trees in the older plantations already contain 100 cubic feet of timber, so that this amount may safely be taken as the average cubical contents of the trees of which sixty per acre are to be left to mature.

As the first regular felling of mature timber cannot take place until the year 1904, it is impossible to estimate the prices that will then prevail. The market depôt will be at Calicut, to which the timber can be transported from the plantations at a cost of 3 to 5 annas a cubic feet. The prices now range at that place from Rs. 1-8-0 to Rs. 2 per cubic feet, so that the Conservator's estimate of a net profit of 10 annas per cubic foot is exceedingly moderate.

From the foregoing data it is assumed that from the 2,484¼ acres which are expected to yield a full crop, 14,906,108 cubic feet of timber will be harvested, realizing Rs. 90,00,000.

It is stated that teak trees may be allowed to stand for fifty years after maturity, and that thus felling on the existing plantations need not close until the year 1986, and will thus be spread over a period of eighty-two years. This makes the average yearly profit Rs. 1,14,375, and the Board calculate that this sum, accumulated until the above date with interest at 4 per cent., will amount to Rs. 684,26,780 against a debt of Rs. 261,14,960 similarly calculated.

Colonel Beddome concludes his report with discussing the question of the extension of planting operations. Land is available, though much of this for different reasons he considers it inadvisable to plant. He would not, it seems, enlarge the planted area until the year 1900, though he would apparently commence to raise a second crop on some of the land already occupied when the trees on it are reduced to their final number of sixty per acre.

The Board of Revenue point out that it will not be necessary as far as the timber is concerned to spread felling over so long a period as eighty-two years, and that if it is to be carried out more expeditiously it may be advisable to undertake further planting.

The question is one of difficulty, and further discussion is in the opinion of Government necessary to its decision. At present the Conservator states there would not be a market at Calicut for an annual harvest of teak of the extent expected, and some experience as to the quality of the timber seems necessary.

KANS GRASS IN BUNDELKHAND.

Extract paras. 1 *and* 2 *of Allahabad Commissioner's No.* 803, *dated* 31*st August*, 1878.

I HAVE the honour to enclose a letter in original from the Settlement Officer of Banda, No. 329, dated 24th instant, with enclosures, containing an interesting report from Mr. E. C. Schrottky, giving the results of his analysis of certain specimens of *már* Bundelkhand soils selected with reference to the growth of káns grass.

2. Mr. Cadell, I think, conclusively shows that the analysis made of the káns-growing soils is incomplete, and that it is desirable to have similar analysis made of the káns-growing soils of *kábar* and *parua*; I therefore recommend that sanction be given to the analysis of these soils, and that a further expenditure of (say) Rs. 800 may be sanctioned for this purpose.

Extract paras. 1 *to* 3, 5 *and* 6, *of Banda Settlement Officer's No.* 329, *dated* 24*th August*, 1878.

I have the honour to enclose a report by Mr. E. C. Schrottky, on káns grass in már, and to solicit your instructions on two points connected with it.

2. When your predecessor was in Bánda last August, I spoke to him regarding the analysis of Bundelkhand soils, and he agreed with me that it was desirable to have analysis made. I accordingly entered into correspondence with Mr. Schröttky, and at first intended to have a fuller investigation made than was eventually undertaken. But I was restrained partly by the expense, and partly by Mr. Plowden telling me that the Geological Survey Department was about to make analysis of our soils.

3. I accordingly asked Mr. Schrottky to restrict his analysis to three specimens of soils, *all már* :—

(i.)—Soil not affected by káns within the memory of man.

(ii.)—Soil under káns and uncultivated.

(iii.)—Soil recently under káns but now again brought under cultivation.

5. As to the report itself, I think the results obtained by Mr. Schrottky must be held to be inconclusive, as the investigation has not extended to kábar and parua. Mr. Schrottky, following the statement of Mr. Court, that káns grows only in már and kábar, and overlooking, I think, my contradiction of that statement, assumes that kans is unknown in parua, whereas it is frequently met with in that soil, and is more prevalent in kábar than in any other soil. Until, therefore, a similar analysis is undertaken with reference to kábar and parua, the investigation cannot, I think, be held to be complete, or the conclusions based on the investigation trustworthy.

6. From his analysis of Mawai már Mr. Schrottky comes to the conclusion that the growth of káns is owing to the superabundance of lime and silica, and to the deficiency of potash and phosphoric acid.

But there is már (see No. 2 in the Geological Survey Assays) in which there is but little lime ; and in the kábar specimens (9,) taken from the most káns-grown neighbourhood, there is very little, while in No. 12, patli rákar, there is more lime than in any other soil. These assays do not give the proportion of silica, but the deficiency of lime in kábar and parua is enough to suggest that assumptions based on the már of Mawai alone are very probably insufficiently supported. So far from Mawai being a fair representative of all Bundelkhand soils, it is not a sufficient representative of Bundelkhand már ; and, interesting as Mr. Schrottky's report is, more and more widely selected instances are required to justify the conclusions at which he arrives.

The only other analysis of Bundelkhand soils of which I know are those extracted from Medlicott's Cotton Hand-book, in pages 48 and 49 of Mr. White's report on pargana Kalpi, and those made by Dr. Murray Thomson for the Betwa Canal Project, given in the same report.

Those analyses, if they show nothing else, show that the extraordinary differences between different specimens of soils of the same class given in the Geological Survey Assays have been observed before, and those of Dr. Murray Thomson, that in már the percentage of lime is sometimes less than in ordinary loam.

For my own part, I have never been very hopeful that chemical investigation will lead to the discovery of any practical remedy for káns. The weed seems to be always ready to spring up, and its presence, is, so far as can be seen, accounted for satisfactorily in very different ways in different villages and tracts.

But it seems to me to be none the less desirable that the chemical aspects of the question should be thoroughly investigated.

If there is a practicable remedy it should be ascertained. If, on the other hand, chemistry cannot help us, it is well that we should be assured of the fact.

The successful administration of Bundelkhand is a problem of sufficient importance to justify the expenditure of a few hundred rupees upon an investigation which, if it does not supply a remedy for a very serious evil may at least put an end to these doubts and questions which periodically arise and divert attention from what, I am afraid, is the only remedy for the ills to which Bundelkhand is liable— that improved revenue administration which shall render the people more prosperous than they have ordinarily been during the seventy-five years of our administration, and therefore more able to contend with the difficulties in their way.

No 5, Middleton Street, Calcutta, 20th June, 1878.

THE SPREAD OF KANS; ITS CAUSES AND REMEDIES, WITH ANALYSIS OF SOILS AND PLANT.

To—A. CADELL, ESQ., C.S., *Settlement Officer, Banda, N.-W. P.*

SIR,—Referring to your letters dated 19th January and 13th March, 1878, requesting me to analyse several samples of soil from fields in the Banda pargana infested with káns (a weed very prevalent in Bundelkhand), and likewise sample of soils from fields on which káns never appears, with the object to ascertain whether chemical analysis of the different soils can throw any light on the cause or causes to which the appearance and disappearance of káns is due, I have now the honour to hand you my following report and the results of my analysis.

I confined myself to the analysis of (1) a sample of soil infested and overgrown with káns, (2) a sample of soil recently grown with káns, (3) a sample of soil on which kans never appears, and (4) the ashes of the plant itself.

As the subject appears to be of considerable importance, it will not be out of place if I preface my report by a *résumé* of what is known about káns. The remarks in brackets are mine : the rest is condensed and based upon information derived from Mr. Mayne's and Mr. Court's reports on the subject published in the Revenue Reporter, North-Western Provinces, New Series Vol. III, No. I, and from the rent-rate report of pargana Maunha of the Hamirpur district.

Káns is a weed very prevalent in Bundelkhand, Rohilkhand, and the Doab, but, on account of the peculiar nature of the soil, is most destructive in the first named district.

Its botanical name or classification seems to be unknown ; it is called a grass [and looks very much like one]. Mr. Edgeworth describes it as *Saccharum spontaneum* ; but then, again, Mr. Court states that it produces a white flower [and therefore it cannot well be a *Saccharum* nor can it belong to the *Graminaciai*]. The plants sent to me were without flower, and I could not therefore positively determine to what family of plants this weed belongs.

I would recommend a flowering specimen to be sent to the Curator of the Calcutta Botanical Gardens for classification, as likely to throw some further light on the subject.

Káns is a perennial weed, springing first from seed, but spreading afterwards chiefly by the roots forming a regular and thick network, which effectually chokes every other plant and stops completely all cultivation. If káns is once permitted to take hold of a field it is almost impossible to eradicate it by any ordinary plough, as the roots strike downwards to a depth of eight or ten feet and are very thick and strong.

The plant itself is some four or five feet high, and its stems and shoots so hard and thick that a man or horse can only with difficulty walk through it.

Káns is peculiar to certain soils, chiefly kábar, már, or the wet már soil representing varieties of a heavy tenacious clay, full of kankar or lime in small pieces ; it never appears in light soils, nor in virgin soils, nor in well-manured or naturally rich clay soils.

It has never been known to take root in these soils [though its seed undoubtedly must have had access to it, but failed to germinate on account it may be surmised, of the absence of some peculiar condition of the soils essential for its development].

If káns has taken possession of any field and is left alone, it exhausts itself after ten to fifteen years' continuous growth [or rather, as I would prefer putting it, exhausts in that period the peculiar elements in the soil which support it]. If, however, the soil is disturbed or cultivated, káns will last longer [that is to say, when atmospheric climatic influences are allowed to act upon the soil by stirring it up, and sets free from chemical combination some more of the peculiar elements káns is partial to ; the additional nourishment thus furnished will prolong the existence of káns beyond the usual period.]

So soon as káns has exhausted the land, after its ten to fifteen years' continuous growth, it dies out, and the land is again fit for the cultivation of agricultural produce.

Káns never makes its appearance again in the same soil for eight to ten years [during which time it can rationally be assumed the action of moisture, heat, and atmospheric air upon the cultivated—that is to say continuously stirred—soil sets free sufficient of the peculiar element or elements essential to the growth of káns. Káns seed will then again germinate in such soils, and unless at once checked, the land must be again abandoned and given up to the growth of káns for a similar period.

There are, it is stated, some old men who have seen káns appear and disappear two or three times within their own memory.

[These peculiar circumstances under which káns appears and disappears give a great scientific interest to the subject of this enquiry, and must be my excuse if I dwell at some length on some points which to many persons will appear at first sight as irrelevant to the main question at issue.]

The only effective means known at present to prevent káns from taking possession of any land favourable to its development is to turn up the young weed year by year by frequent ploughing, and to sow for crops as usual. This requires of course strong ploughs and bullocks, and the fields must be continually and carefully attended to, for if once the roots of this weed get below the depth of the plough, all endeavours, within the reach of the ordinary ryot, to eradicate it are futile, and the land has to be abandoned for ten or fifteen years.

Overcropping is said to be one great cause of the appearance of káns, but beyond this nothing is suggested which could give a clue to the discovery of the real direct cause to which the appearance of this injurious weed is due.

It is universally admitted that at certain intervals the soil is more predisposed to grow káns than at others, and large tracts—nay, whole villages—have to be abandoned and thrown out of cultivation on account of it if at any time unfavourable seasons impoverish the ryot, reduce the number of his ploughs and bullocks, and thus disable him to give the land the extra cultivation required to keep down the weed at first appearance.

Passing now from these general remarks on what is known about this reed, and what can be deduced from it, to the results of my analyses which are appended, we find on comparing the different items of analyses of soils, No. I [never affected with káns], soil No. II. [overgrown with káns], and of soil No. III [recently grown with káns], first a large excess of organic matter in No. II soil, occasioned undoubtedly by the accumulation of roots and stalks of káns in the soil. Potash and soda as well as phosphoric acid [all three important elements of mineral plant food] are present in much smaller quantities in Nos. II. and III than in No. I soil, and the two first must, therefore, be classed as much poorer soils, giving support to the observation that káns will never grow on virgin or well-manured lands, and that injudicious exhaustion of the soil is one of the causes of its appearance

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Printed at the "Statesman" Office.

There is some additional potash and phosphoric acid present in these soils, but in such powerful combinations as to be insoluble in hydrochloric acid. This quantity as usual has not been separately estimated, but is included under clay.

The difference of the quantity of the oxide of iron and alumina between the three specimens of soils can be disregarded as not affecting plant life to any extent.

But the chief difference between these soils, which throws some light upon the cause why káns will not grow in No. I soil, while it flourishes in Nos. II and III, is evidently the proportion of lime and soluble silica.

The amount of lime in No. II and No. III soils exceeds that of No. I by 50 and 68 per cent respectively, and, likewise, the amount of soluble silica in No. II and No. III exceeds that of No. I by 128 and 156 per cent. respectively.

Judging, therefore, from the chemical composition of these soils, it would appear as if a certain excess of lime and soluble silica, and poverty of the soil in potash, soda, and phosphoric acid, were essential to the development of káns.

But, while giving due weight to the results of the ordinary chemical analysis of these soils, it must be borne in mind that such an analysis shows us, indeed, what the soil consists of, and how much of each element of mineral plant food, soluble in hydrochloric acid, is present; but it does not reveal to us how much of each of these elements is available to the plant.

The mineral plant food in arable soil, such as potash, soda, lime, and magnesia, sulphuric, phosphoric acid, and silica, is present in two different states of combination, *viz.*, in physical combination with the soil and in water in insoluble chemical combinations with each other.

To make this point clear, a piece of granite I lately analysed consisted of silica 72·65, oxide of iron 7·1, alumina 8·95, lime 2·82, magnesia and alkalies 5·2, phosphoric and sulphuric acid 0·28, water of combination and loss the remainder.

All the elements of mineral plant food are there; but if we were to powder this piece of granite and try to grow any plant in the powder, we would fail in our experiment, as the plant cannot absorb a particle of the plant food which is present, it being in chemical combinations insoluble in water.

In course of time the constant action of moisture, heat, and atmospheric air severs these chemical combinations; the granite powder will become gradually decomposed, the different elements of mineral plant food are set free, become soluble in water or in water containing carbonic acid and are then available and can be absorbed by the plant.

Precisely the same process takes place continually in the arable soil of our fields, with the difference that as the different elements of mineral plant food are set free from their chemical combinations and become soluble in water pure and simple, or in water containing carbonic acid they immediately enter into a kind of physical surface combination with the porous particles of the arable soil which prevents them from being washed away and removed from the surface soil by rain and drainage.

If water containing in solution a certain quantity of potash, soda, lime, phosphoric acid, silica, &c., is allowed to percolate through a stratum of arable soil, a certain quantity of these substances will be retained by it, entering with it into a physical surface combination; and the soil will continue to abstract such soluble mineral plant food until its affinity for it is satisfied and saturation takes place; after this, all soluble mineral plant food passes through without any absorption taking place.

Now the physical affinity of the soil for mineral plant food in a state of solution in water is greatest for potash and phosphoric acid, the two scarcest and most important elements of mineral plant food, while its affinity for lime and silica is smallest, these being, so to speak, the commoner elements and generally present in abundance. Deep well water, therefore, always contains them, the soil permitting them to pass through unabsorbed.

Now, the rootlets of plants come in contact with and press against the particles of the soil which are enveloped by the mineral plant food that entered into physical surface combination with them; a constant change is going on between the cells of the rootlets and the moisture without; osmose and exosmose come into play, which, combined with the vital power of the plant, overcomes the affinity the soil possesses for soluble mineral plant food; the latter becomes again soluble in water, and is thus absorbed by the plant.

We speak, therefore, of *available* and *unavailable* mineral plant food in the soil—the former once soluble in water, but bound by the physical affinity of the soil; the latter still in insoluble chemical combinations with each other, and, while thus, unfit for plant food until by the action of moisture, heat, and atmospheric air these combinations are severed.

It follows, therefore, that we have reasons to believe that germination and the development of any particular plant is dependent upon a certain excess of lime and silica, this excess must consist of *available* lime and silica. If by ordinary chemical analysis we find that a soil in which káns never grows contains 6·5 per cent. of lime and 3·2 per cent. of soluble silica, and another soil peculiarly favourable to the development of káns and overgrown with it is found to contain 10·6 per cent. of lime and 7·32 per cent. of soluble silica, we may reasonably suspect that this excess of lime and silica has something to do with the presence of káns; but we cannot speak positively until we know how much of this lime and silica is available as food and influences the plant.

Now, agricultural chemistry has not yet discovered any acid or solving medium which exactly corresponds in dissolving power to the force of osmose and exosmose combined with vegetable vitality; it is practically unable to ascertain how much available mineral plant food there is in any particular soil, or how much of each constituent.

Ordinary chemical analysis cannot distinguish between powdered granite and arable soil, and it is therefore, extremely hazardous to judge of a soil and report on its peculiarities simply on the basis of an ordinary chemical analysis.

I have gone into great length in explaining the difference between available and unavailable plant food, as it has important bearings upon the subject submitted to me for report; for on the basis of the results of the experiments detailed below, I have come to the conclusion that *an oversaturation of the soil with available lime and silica, and notably the latter, is essential and necessary for the germination and development of káns.*

I percolated 1,000 grains each of soils Nos. I, II and III with very diluted [1 in 100] acetic acid containing half per cent. of hydrochloric acid and 2 per cent. of carbonic acid [the last by volume]. Having found after many experiments that this mixture has very little effect upon mineral plant food in chemical combination, while it dissolves nearly all available plant food, I do not claim this mixture to be the exact equivalent of the force of osmose and exosmose combined with vegetable vitality, but I have every reason to believe that the results are approximately correct and sufficiently, so far as general conclusions.

The ordinary chemical analysis having given me the clue, I only estimated lime and magnesia.

Forty ounces of the above described liquid containing acetic, hydrochloric, and carbonic acid, were percolated through a thousand grains of each of the soils and dissolved out of—

	Soil No. I.	Soil No. II.	Soil No. III.
	Grains.	Grains.	Grains.
Lime	12·2	30·3	28·5
Silica	4·1	12·6	11·9

I further percolated 10,000 grains of each of these soils with two pints of distilled water, and found it abstracted from—

	Soil No. I.	Soil No. II.	Soil No. III.
	Grains.	Grains.	Grains.
Lime	0·6	10·3	11·2
Silica	0·12	2·4	2·3

The results of these two experiments lead to the conclusion that there exists a distinct peculiarity in soils No. II and No. III, this peculiarity consisting of an oversaturation with available lime and silica; and this peculiarity not being shared by soil No. I points to such oversaturation as an essential and necessary condition for the development of káns.

This excess of lime and silica in soils No. II. and No. III is, however accompanied, as analysis shows, by great poverty in potash and phosphoric acid, two most important elements of mineral plant food for the majority of our agricultural produce; hence it can be rationally concluded that if these soils were oversaturated as well with potash, phosphoric acid, &c., káns would not be able to exist in them.

To favour, therefore, the development of káns, the oversaturation of the soil with available lime and silica must be accompanied by a corresponding want of available potash and phosphoric acid.

The analysis of the ashes of káns shows that it is an essentially siliceous plant, silica and lime being the chief constituents, the ashes containing—of the former 75·5, of the latter 9·3 per cent. The specific character of the plant would have come out sharper under analysis if the *flowering* plant food would have been sent to me, as only at that period the plant contains all the elements of mineral plant food in the proportions essential to its development and propagation, and the safest deductions can be made from an analysis of the plant at that stage of existence.

To sum up, káns is a siliceous plant, flourishing in soils which contain an excess of available lime and silica, notably the latter, and are at the same time poor in available potash and phosphoric acid.

It will develop in such soil to an extent precluding all cultivation, and its principal mineral food being lime and silica, will take up yearly a considerable quantity of these two substances in their available state, and fix them in insoluble combinations within its cells. If the decomposing action of moisture, heat, and atmospheric air is reduced to a minimum by not stirring up the soil, then very little lime and silica will be set free to and to the excess already existing; and under these circumstances the continuous growth of káns will absorb every year a certain proportion of this excess of lime and silica and exhaust it, as observation has shown at the end of ten to fifteen years, sooner or later, according to the nature of the soil.

As soon as this excess is exhausted, the condition essential to the development of káns has ceased to exist, the weed dies out, and the land is again fit for cultivation.

If, however, the land occupied by káns is stirred up, more lime and silica is rendered available from their chemical combinations, and the period during which káns exhausts the excess of these two elements of plant food will be prolonged.

As said before, after káns has died out, the land can again be cultivated for the ordinary crops. Cultivation exposes all particles of the surface soil to the decomposing action of climatic influences; lime, silica, potash, phosphoric acid, &c., are set free, and rendered available to vegetable plant life. The land being either altogether poor in potash and phosphoric acid, or containing these elements in powerful chemical combinations not so easily decomposed as the lime and silica combinations, preponderating

quantities of the latter two elements, largely in excess of what the ordinary crops can absorb, will be rendered available.

These quantities being accumulations, the soil will, after a certain number of years, contain such an excess of lime and silica as to make it fit again for the growth of kâns.

What will be the number of years—said to vary between six and eight—will depend entirely upon what crops are grown on it.

If wheat or other siliceous plants are grown, which in addition to potash, phosphoric acid, &c., abstract likewise a considerable quantity of the silica set free year by year, then a greater interval will elapse before the land becomes again fit for kâns; but if non-siliceous plants, such as juár, gram, &c., are raised, which require for their growth large quantities of potash and phosphoric acid, but very small quantities of silica, then the land will become sooner fit for kâns. Mr. Mayne's statement, that some people say "that kâns follows juár with greater force," adds considerable weight to the above abstract deduction.

The direct causes, to which the appearance and disappearance of kâns is due is once recognised, the remedies are simple enough and should prove efficient.

I know nothing of the lay of the land on which kâns grows; but if there was a good natural subsoil drainage, experiments have shown conclusively that no oversaturation of the soil with available lime and silica can take place. The soil possesses but feeble physical affinity for these two elements of mineral plant food, while its affinity for potash and phosphoric acid is very great; and if there was a good natural subsoil drainage, any excess of lime and silica would be at once removed from the upper cultivated stratum.

I would recommend, therefore, as a remedy against kâns, to drain the soil by drains 4 to 5 feet deep, 2 feet wide, and 30 to 50 feet apart, and either leave them open and then with embankments, so as to prevent surface drainage, or cover them up with soil after having previously half filled them loosely with stones or brushwood.

All these drains must of course incline to the open drainage of the country. The soil must be loosened so as to enable rain or irrigation water to run through it, not over it. It may either be hoed, or, if the great strength of the roots of kâns make that impracticable, it should be straight-holed, six or nine inches deep and six or eight inches apart, with a crowbar or similar straight implement.

It is not necessary to dig up the kâns, that will die of its own accord as soon as subsoil drainage actively sets in and removes the excess of available lime and silica.

This operation should be aided by spreading over the soil newly-burnt and slaked lime at the rate of one to 1½ ton per acre.

Any kind of kankar or limestone can be burnt for the purpose. After spreading the caustic lime over the soil, it should be lightly dug into it. The greatest effect will be obtained if the land has a good natural or artificial watering immediately the lime is dug in.

Lands thus treated will give double and treble the average yield for a number of years, and this will amply cover the extra expenditure of reclaiming them from kâns.

It may appear strange to recommend the addition of lime to a soil which is already too rich in it, but in this case it is not used as a *manure* in the narrow meaning of the word, but it is used on account of its powerful chemical action in its caustic state. Caustic lime will burn up the kâns; decompose rapidly, and to the benefit of succeeding crops, the excess of organic matter accumulated in the soil by the continuous growth of the weed; it will set free from their chemical combinations potash and phosphoric acid, which are greatly wanted in these soils, and combine with the available silica to an insoluble silicate of lime; while any excess of lime will be removed by subsoil drainage.

I remember an instance which came under my personal observation of a field in Germany being for years covered with the common scouring rush (*equisetum*) to such an extent that *equisetum* seemed to be the crop, and rye, which was grown on the field, an adventitious weed.

Equisetum, I may mention, is also a weed requiring large quantities of available silica for its sustenance, its ashes (*Equisetum hyemale*) having been found to contain no less than 97·5 per cent. of silica. I saw this field subsoil-drained, and the *equisetum* disappeared totally, as if by a miracle, within one year.

Appended are the results of my analysis of the three soils and of the ashes of kâns.

I have, &c.,
(Sd.) EUGENE C. SCHROTTKY.

RESULTS OF ANALYSIS OF SOILS FROM MAUZA MAWAI BUZURG, PARGANA BANDA.

(Soil No. I, a rich clayey soil No. II, calcareous clay soil, poor in potash and phosphoric acid, subsoil consisting of clay and kankar; soil No. III, same class of soil and subsoil as No. II. No subsoil was sent of No. I).

100 GRAINS CONTAIN OF	No. I. Field No. 434, never affected with kâns.	No. II. Field No. 410, not cultivated and is overgrown with kâns.	No. III. Field No. 438, recently grown with kâns.
Organic matter and water of combination	4·50	8·19	6·50
Potash and soda as chlorates and sulphates	1·28	0·36	0·83
Lime carbonate	0·50	10·6[illegible]	9·09
Magnesia do.	0·80	0·80	0·50
Phosphoric acid	0·28	0·1[illegible]	0·15
Oxide of iron and alumina ..	6·18	8·30	10·20
Soluble silica	8·20	7·32	8·20
Clay and sand insoluble in hydrocloric acid	78·31	64·11	65·53
	100·00	100·00	10[illegible]

RESULTS OF ANALYSIS OF THE ASHES OF KANS (THE WEED NOT BEING IN FLOWER).

The whole plant was carefully incinerated.

100 grains of the ashes contained—

Potash and soda	4·6
Lime	9·3
Magnesia	3·2
Chlorine	0·3
Sulphuric acid	0·8
Phosphoric acid	2·1
Oxide of iron and alumina	4·2
Silica	75·5
	100·0

(Sd.) EUGENE C. SCHROTTKY.

NEW COMMERCIAL PLANTS.

MR. THOMAS CHRISTY, F. L. S., is indefatigable in bringing these to public notice. In pamphlet No. 2, he gives an account of *Gynocardia Odorata*, the Chaulmugra tree, the seeds of which yield an oil (Chaulmugra oil), which has long been known and valued in India for the cure of leprosy and allied diseases. We are told that :—

Chaulmugra Oil is now being used in St. Peter's Hospital, Berners Street; the Infirmary at Margate; in the Royal Hospital for diseases of the chest, City Road; in St. John's Hospital, Leicester Square, and other Hospitals, and by several leading members of the medical profession in London.

Next we have an account of Vogel's African rubber tree, *Urostigma vogelii miq.*, of which we are told :—

The tree will grow near the sea at an elevation of 50 to 60 feet above sea level, but does not flourish well in marshy ground.

The ease with which the plant is propagated, its hardiness in sea air, and the excellent quality of the rubber which it yields, render this a desirable species for cultivation in the lowlands of southern India and Ceylon; also in Java, Sumatra, Penang and Siam.

The mahwah tree (*Bassia Latifolia, Roxb.*) forms the subject of the next article. From time immemorial, an intoxicating drink has been made in India from the flowers of this tree. More interesting is it to know that the sugar which leads to fermentation makes the flowers valuable for food. Listen :—

The flowers are produced in enormous quantities in March and April, after the old leaves have fallen and before the new leaves have appeared; the crop rarely fails. The fleshy flowers fall off and cover the ground beneath the trees, and are gathered eagerly by the natives every morning during the flowering season; a single tree yields from 200 to 400 lbs. weight of flowers. These flowers are stored as a staple article of food by the Bheels and other tribes, and so valuable do they consider these trees, that in time of war the threat of cutting them down generally reduces them to submission when unruly.

The flowers when dried have somewhat the odour and appearance of Sultana raisins. Lately examined by a French chemist, M. Petit, they were found to contain half their weight of sugar, and are therefore very nourishing.

In a paper recently read before the Linnæan Society by Mr. Lockwood, that gentleman stated that wild animals of many kinds troop eagerly to the mahwah trees during the season to feed on the flowers. He was therefore led to experiment upon domestic animals, and it was found that the flesh of pigs fed upon mahwah flowers in this country was much improved and acquired a delicate flavour. The animals so fed rapidly came into condition. Again :—

The tree thrives in poor stony ground, and might therefore be cultivated on land not available for other crops. So regular is the yield of flowers, that it is said a bad mahwah harvest has never been known in India. The flowers when dried will keep for almost any length of time, and do not appear to be attacked by insects.

From the seeds an oil is extracted by the natives; it is used for lighting purposes and for soap-making. The smoke arising from the burning of the oil-cake, after expression of the oil, is said to be poisonous to rats, &c.

The mahwah tree, then, affords a means of obtaining an almost unlimited supply of food, both for man and beast, a food which will keep a great length of time in any natural temperature, and which requires no trouble to procure, and no outlay in cultivation. The tree readily propagates itself by seed which, in India, is usually self-sown.

As of special local interest we quote in full the notice of cacao :—

Theobroma Cacao.

It is not generally known that the flavour of cocoa depends upon two things;—first the nature of the soil, and secondly, the preparation of the nib after it is taken out of the fruit.

The finest cocoa in the world is grown on one farm in Guatemala, but the natives pay such a high price for it, that there is only a small quantity exported for experiment or, occasionally, as a curiosity. I am informed by a gentleman holding land within a mile of this farm, that they cannot grow such a fine quality or anything approaching it. Seed obtained from this farm has been grown in other localities without any better result than from ordinary seed.

The Trinidad cocoa commands a high price in the market, and an account of the mode of preparation of the nib will, therefore, be of interest to all growers.

The best cocoa is picked from the pod, and the nibs or nuts are then placed in a pile and fermented with plantain or other green leaves for 5 to 7 days, according to the market for which it is intended. The heap will get so hot that the hand cannot be kept in it an instant. The nibs are then taken out of the pile and dried in the sun, and afterwards retain a rounded surface. This treatment makes the difference in the price of cocoa, between 50*s*. and 108*s*. per cwt. Ordinary cocoa is only fermented for three days. The fermentation takes out the better flavor. The Spaniards will pay a very high price for specially cured cocoa. Poor and small seeds cannot support the same amount of fermentation that large, fat, round nibs will. The fermentation destroys the germ of vegetation, and prevents the nib from growing musty.

I have had great success with the live seed collected in Trinidad and on West Coast of Africa, repacked in my own warehouse in London, and re-shipped to Ceylon and Batavia, where it has arrived in good order, packed in earth and moss in Wardian cases.

It will be seen that the quality of cocoa, equally with tea, depends on careful fermentation. It remains to be seen whether the kind of bean or properties of soil have greater influence as to goodness of results.

CONDITION OF THE MADRAS PRESIDENCY.

We append an extract from the Foreign correspondent at Madras of the *Agricultural Gazette*, of December 23rd, 1878, which may be found interesting :—

That the agricultural condition of this Presidency is in a deplorable state, no one who has studied the returns of cropping and stock which are available can doubt. From the former it may astound you to hear that of the area of crops raised.

76·2 per cent,	are	cereals.
9·2	"	pulses.
12·8	"	industrial crops.
2·0	"	garden crops.
100 0		

The garden crops are the only ones which are regularly and systematically manured; a small portion of the cereal crops also occasionally receive a small quota of fertilizing substance, besides what paddy crops get in the shape of the silt, &c., brought to them in the water used for irrigating them. The industrial crops may be classified as follows :—

Cotton	45·5	per cent. of the area occupying them.
Oilseeds	43·5	" " "
Indigo	8·6	" " "
Other crops	2·4	" " "
	100·0	

If we classify all the crops as exhaustive and restorative, supposing that they are properly used, the results will be something as follows :—

Exhaustive crops occupy 93·4 per cent. of the cultivated area.

Restorative crops occupy 6·6 do. do.

There are, however, about 5,000,000 acres of land left idle, "waste," annually ; the total area under crop being about 23 5 million acres ; this land is not fallow, but simply left uncropped for a time. There is, besides the land left "waste," about 1,000,000 acres of land relinquished by the tenants annually, which will no longer produce remunerative crops ; the area annually relinquished has been rapidly increasing of late years, and in this is to be seen confirmatory evidence of the belief in the exhausted condition of our Indian soils, which has, of late years, been gradually growing so universal.

Regarding the live-stock of the country, it may not be uninteresting to note the following figures for live-stock per square mile of territory :—

	Cattle.	Sheep and goats.
Great Britain	... 66·6	325·0
Belgium	... 109·4	68·9
France	... 57·2	131·3
Madras Presidency	... 93·1	76·9

If we also take into consideration the diminutive size of Indian stock, the small number maintained is very striking. If the total number of live stock in this Presidency, according to the latest returns—those for 1872—be reduced to cattle, by calculating five sheep as equal to one bullock, it will be found that for every 100 acres of arable land, there are only 44 head of cattle to provide ploughing power, breeding stock, and manure. The stock per acre decreased in the 15 years before 1872 by over 10 per cent. During the same time the average area tilled by the plough decreased by nearly 16 per cent,—very probably owing to the deterioration of the ploughing cattle. The area of the cultivated land, on the other hand, during the same period, increased by over 17 per cent., showing that the natural grazing or fuel-producing grounds of the country were reduced by nearly 8,000,000 acres. The number of ploughing cattle increased during the 15 years, but that of cows decreased by nearly 14 per cent. Whether the decrease in the five following years has been commensurate I do not know, for, though due in July 1877, the quinquennial returns, from which I take the above figures for previous years, have not yet seen the light of day.

These facts may enable people interested in Indian agriculture to form some idea of what conditions exist—at least in the Southern portion of the peninsula.

GARDEN.

"*Apropos* of trees," writes a correspondent in the Southern presidency, "there is one which I think ought to be planted in every garden in Madras. It is the *Cerbera Odallum*, a native of salt swamps on the coast of Malabar and common in the Maldive and Laccadive Isles. It flourishes exceedingly well in Madras, and I think, nothing can be more refreshing than the white, fragrant flowers with their deep, shining green leaves. Shrubs of the wax-flower plant also grow easily and well here ; its flowers are of a wonderfully pure, soft white, are generally double and fragrant during the night. The large flowered Cryptostegia, a fine twining shrub is doubly useful ; it makes very thick high hedges and yields a fine, strong fibre, resembling wax. It is ornamental too ; I know nothing prettier than its large, soft, rose-coloured, bell-shaped flowers which look exceedingly well with a back ground of deep-green near the snowy wax plant, and the cool white sprays of the *Cerbera Odallum*. All these three species I have mentioned require little coaxing, and flourish with comparatively little care, which is a great consideration. They can stand rain, dry heat and hot winds wonderfully, and the stormy, changeable weather we have had lately has little effect, as far as I can see, on these sturdy growths."

Strawberry plants.—A supply of strawberry plants, of a new species, was lately received by the Government from New South Wales, and ordered to be sent to the Superintendent of the Botanical Gardens, Ooty.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 19th December 1878.

The Hon'ble L. S. Jackson, C.I.E., President, in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. Walter Knaggs, Edward Scarth, Baboo Grija Prosunno Mookerjee, and the Hon'ble Mr. Justice Wilson.

The names of the following gentlemen were submitted as desirous of joining the Society :—

T. T. Leonard, Esq., Bangalore,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

The Manager, Lallacherra Garden, Cachar,—proposed by the Secretary, seconded by Mr. J. E. Machlachlan.

W. St. Clair Grant, Esq., Latipore Concern, Bhaugulpore,—proposed by Mr. G. H. Grant, seconded by the Secretary.

Manager, Paikpara Estates,—proposed by the Secretary, seconded by Mr. Cogswell.

Rejoined—Major W. Franklin, 2-14th Regiment, Lucknow.

Contributions.

1. The *Indian Forester*, No. 2, of Vol. 4. From the Editor.
2. Proceedings of the Agricultural and Horticultural Society of Madras for past three years. From the Society.
3. Report on the Internal Trade of Bengal for 1877-78. From Government of Bengal.
4. A Wardian case of plants. From the Acclimatisation Society of Queensland.

Garden.

The Gardener's monthly report was read, of which the following are extracts :—

"The work done has been somewhat similar to last month. Road-making, and repairing, tidying up flower garden, &c. The only two remaining *malees* we have, have been engaged amongst the roses, propagating house, and potting."

Resolved, that renewed efforts be made to secure the services of at least six good *malees*, though it may be difficult to do so as the demand for this class appears to exceed the supply.

Mr. Gleeson submits reports on the condition of two Wardian cases of plants received from the Botanic Garden, Singapore, and from the Queensland Acclimatisation Society. Of the former (46) nine have died : of the latter (59) seventeen have died.

It was resolved that the Annual Exhibition of flowers and vegetables be held on Tuesday, the 28th January, and the details submitted by the Council were agreed to. Due notice to be given by advertisement early next month.

In respect to the provision of vegetable and flower seeds for next year, it was resolved that the orders be confined to England and America, as those imported this year from France and Germany, have not been generally well reported on.

It was further agreed that a collection of bulbs and tubers be imported in due season from England, to be disposed of to Members at cost price ; also ornamental plants and fruit grafts on due security being given by applicants as to the amount of cost of the same.

The Council submitted the result of their endeavours in the past two years towards the engagement of a practical entomologist in connection with blight of various kinds affecting tea plants. Several references both by circular and personal application had been made to various agents connected with the tea industry. Some had readily promised to support the scheme, provided others would agree to do so. As however, many, though apparently well inclined, would not come to any definite understanding, the Council now suggested with regret, that the project be abandoned. *Resolved*, that the recommendation of the Council be adopted.

NOTICE OF A PECULIAR PINE-APPLE FROM MYMENSINGH.

The Secretary read the following extract of a letter from a lady correspondent on the above subject :—

"I enclose you a very hasty sketch of a most peculiar pine-apple. It was grown somewhere in these parts and brought in a *dalee* to our Collector who gave it to me. I was inclined to think it was a *Lusus naturæ*, in vegetable life, but he said he thought *not*, and subsequent enquiry seems to confirm this. We hear that one year seventeen were brought from the same place, and another year twelve, and I have been promised a plant of this peculiar pine-bearing species I have not exaggerated one whit, the centre pine was much over a foot long, tapering downwards and terminating in what looked like three fingers. These were nothing but the pine itself extending a little way, (the upper and thicker part of the fingers so to speak) the thinner part being embryo leaves terminating in a little tuft. From the top *seven* smaller pines projected, each terminated by a tuft of leaves. I would have sent you this had it been possible ; but as I feel sure you would be glad to hear of it, I have described it as well as I could. I must tell you that it possessed the full scent of the pine, and when one of the smaller ones broke the juice literally ran from it. Have you ever heard of such a species? Pines are so common in the surrounding districts that they are used for making hedges. We are going to plant all the tufts from off the little pines, or shall I call them pinelets? We hang it up by the stalk, hence my describing the stalk end as the top."

The Secretary added that he had communicated with Mr. John Scott, in reference to the above letter, and he had obligingly recorded the following remarks :—

"I have occasionally seen fruits of the pine-apple very similiar to that of which you send me the sketch and description from your correspondent. The *sorosis* form of fruit (as represented by the pine-apple, the bread-fruit, and mulberry) consists as you know of a shortened spike or raceme in which the tracts and floral envelopes are more or less succulent, united, and converted into a fleshy fruit. Now, as in the case above referred to, some varieties have a tendency to become proliferous, and the individual flowers form separate and independent fruits. I may remind you of the Chinese variety, known as the many-headed pine, in which the individual flowers are all converted into miniature, but perfect fruits, each, as well as the central axis, bearing a terminal leaf shoot.

"Your correspondent's variety differs considerably from this, as would appear from the sketch and description. It would be well worth adding to your collection."

CURIOUS HORTICULTURAL CIRCUMSTANCE.

Read the following note from Colonel W. H. Lowther :—

"For some years past I have been endeavouring to hybridize that beautiful *Convovulus*, *Ipomœa rubro cœrulea*, (the *true blue*) with its white variety. I obtained the seeds of the latter while I was at Jubbulpore, and have for several seasons sown the two mixed together, without any results in variegation, or the originazation of any variation : this cold season to my astonishment, the produce of these repeatedly associated colours, has ended in the whole of my stock being *pure white!* The plants are very vigorous, and are growing in all aspects, sunny, and shady, and in the same rich quality of soil. The flowers are full sized, and are frequently mistaken by strangers for the "Moonflower" (*Ipomœa grandiflora*).

"Is there any recognized law of 'Vegetable Physiology' which can shew a tendency to the 'Albino Type ?' "

Note by Mr. John Scott.—"With reference to the results of Colonel Lowther's experiments in the annual mongrelizing of the white and blue flowered varieties of *Ipomœa rubro cœrulea*. I am not at all surprised. Both in the animal and vegetable kingdom it is well known ; that albinism is strongly inherited. In treating of inheritance in plants Mr. Darwin observes, "that it is a singular circumstance that white varieties generally transmit their colour much more truly than other varieties. This fact probably stands in close relation with one observed by Verlot, namely, that flowers which are normally white rarely vary into any other colour.' 'I have found,' continues Mr. Darwin, 'that the white varieties of the *Larkspur* and the *Stock* are the truest. It is, indeed, sufficient to look through a nurseryman's seed-list, to see the large number of white varieties that can be propagated by seed."

"These remarks of Mr. Darwin's have, however, mainly relation to natural variations, while Colonel Lowther's case is a result of mongrelism. Now, in this as in hybridism, there is nearly in every instance *Ipomœa rubro* a strong tendency evinced in the successive progeny of such unions to revert to one or other parent, so the *cœrulea* case goes to show that as in the inheritance of natural albinism, so in that of mongrelism the albino form is the more strongly inheritable. As an analogous case, I may observe that *Ipomœa purpurea*, which has given rise to varieties varying from blue to dark purple, crimson and white, there is a great tendency, when grown together for successive seasons, in the white variety to predominate, and indeed alternately displace all the others. On the other hand there is no difficulty in keeping up the several varieties when grown separately, so that the former result is no doubt largely attributable to intercrossing by insects."

FIBRE OF MALACHRA CAPITATA.

Read a letter from J. E. O'Conor, of the Department of Revenue, Agriculture and Commerce, forwarding a sample of fibre of the *Malachra capitata* prepared at Bombay and sent to him by Dr. Gray, (Mr. O'Conor's notes on this fibre are inserted in the last published number of the Journal, Vol V., Part 4.)

The Secretary intimated that the Members of the Fibre Committee had examined the above sample and submitted the following remarks thereon :—

Minute by Mr. S. H Robinson.—"I have no doubt this fibre would prove a good substitute for jute for most purposes to which jute is applied : but it seems rather more harsh and its spinning qualities should be tested in one or two Jute Mills before giving a very decisive opinion. To ascertain whether it would prove economically a substitute for jute, we should require to know the yield of fibre per beegah or acre and the cost of cultivation and manufacture."

Minute by Mr. W. H. Ogilvie.—"This sample is beautifully bright and clean, fair length and good strength of staple, but somewhat harsh. I doubt if it would make a good warp yarn in itself, but mixed with good jute it would do so. The fibre for spinning is not so valuable as jute, it lacks the forked ends, when broken, such as the latter possesses, and partakes of the character of the fibre known as 'Meshta,' which, when broken, looks as though it had been cut and left with square ends."

"Before its value as a spinning fibre could be fairly assessed in competition with jute, it would be needful to show cost of production, outturn per beegah, &c." Letters were read—

From Director, Department of Agriculture and Commerce, N.-W. P., submitting for an opinion a small specimen of colored seeded cotton raised in the Etawah district from seed brought from Mecca. This specimen being too small for satisfactory examination, a further and larger quantity has been applied for. The seed has been sown in the Society's Garden.

From J. F. Duthie, Esq., Superintendent of Botanic Garden Saharunpore, forwarding seven different specimens of cotton raised in the garden. Referred to Cotton Committee.

From H. L. LeMesurier, Esq., Minister of Public Works in Egypt, applying for seeds of jute and notes on cultivation thereof. Complied with.

Mr. LeMesûrier applies for seeds of various other useful plants which he wishes to introduce into Cairo. This request is receiving attention.

From the Assistant Director, Royal Gardens, Kew, returning thank, for back numbers of the Society's proceedings.

From the Secretary, Agricultural and Horticultural Society, Madras. Returning their thanks for Journal, Vol. V., Part 4.

For the above communications and presentations the best thanks of the Society were accorded.

BOTANICAL GARDENS AND PARKS IN THE NEILGHERRIES.

WE make the following extract from Mr. A. Jamieson's interesting Report on the Progress and Condition of the Government Botanical Gardens and Parks on the Neilgherries for the year 1877-78 :—

During the past year 746 fruit trees, 2,154 timber trees, 10,084 ornamental trees, shrubs and budding out plants, 3,063 packets of vegetable and flower-seeds, 60 bouquets and 414 baskets of cut-flowers were sold from the gardens.

Potatoes.—Attention still continues to be directed to the cultivation and improvement of potatoes on the Hills. The notes compiled and published by me in August last have been widely circulated among cultivators, and it is hoped that by adhering to the simple rules therein laid down, some good may result. Upwards of 50 maunds of healthy seed potatoes were distributed from the gardens gratis among European and Native cultivators in quantities varying from one to four maunds. The Ootacamund Monigar reported that those supplied to him were a total failure. A report to the same effect was received from a planter at Kulhutti who was supplied with a similar quantity, but there can be no doubt that the non-success in the first instance was entirely due to their having been planted on unsuitable land. The unusually wet autumn of last year was also much against the production of potatoes of good quality. The entire crop on the Hills having been more or less affected by disease, especially where planted on heavy low-lying lands, sixteen maunds of the most improved kinds were imported from Australia this spring. These are now in the ground and look exceedingly promising not having shown the slightest sign of being affected by disease. Their produce will be planted again in October, so we should have at least 100 maunds of sound seed available for distribution in the spring of next year.

Fodder Plants.—In November last 30 lbs. of seed of *Sorghum Saccharatum* and 20 lbs. of Planter's friend (*Sorghum Kaffrarium*) were received through the Commissioner of the Neilgherries from the Superintendent, Government Farms, Madras. This seed was distributed in quantities of 1 and 2 lbs. to planters and others on the Hills and in Wynaad interested in the cultivation of fodder-yielding plants, some of whom have reported favorably on it as will be seen from the annexed extract from letters received from them. A small quantity of each was sown in the Ootacamund and Kulhutti Gardens and in Sim's Park, Coonoor. That sown in the Ootacamund Garden did not thrive, the climate being evidently much too cold for it ; that which was sown at Kulhutti and in Sim's Park has thriven admirably, and is now bearing a heavy crop of grain. This acclimatized seed will be distributed or further experiment this autumn.

Cuzco Maize.—About 12 lbs. of seed (raised in Sim's Park, Coonoor) of this valuable maize was distributed last year. It has proved a great success on the Neilgherries when grown at elevations varying from 4,500 to 6,000 feet, but when grown at lower elevations, it fails to produce grain, and is valuable in Wynaad as a green fodder plant only. Being rich in saccharine matter, it is eaten greedily by all kinds of cattle.

Santung Cabbage.—Last year a quarter of an acre of the garden nurseries was devoted to the production of seed of this valuable plant. This seed has been extensively distributed, and all who have received it (with but one exception) speak of it in the highest terms both as a table vegetable and as green cattle-fodder. The native gardeners around Ootacamund are now growing it largely and seem to find a ready sale for it in the local market. There is not the slighest doubt, but it is the heaviest cropping and most valuable cattle-fodder yet introduced to the Neilgherries.

Prickly Comfrey.—A piece of well-manured ground, 80 yards broad and 40 yards in length, was planted with Prickly Comfrey in June, 1877, but I regret to say, that the foregoing remarks on Suntung cabbage cannot be equally applied to this plant. During the rains and on highly-manured land it yields a fair quantity of fodder, but during the dry weather (or when fodder is most valuable) it ceases to produce leaves. It seems to me to require a long season of rest and even irrigation, and any amount of good treatment will not induce it to grow during the dry season. Many planters in Wynaad and on the Neilgherries, who at considerable expense imported and planted it largely, have now abandoned its cultivation as a total failure. The following few extracts from letters received from planters on the above subjects may be interesting.

From J. Ryan, Esq., Planter, Cherambady:

"The cuzco maize seed you kindly gave me was sown on the 28th December and germinated in five days. It grows luxuriantly, but bears very sparingly; the ears seemed full, but consisted chiefly of fibrous covering. I have preserved the seed to sow again. The sorghum was a great success and bore a rich fold. I hope to plant a small field of it this season. The Santung cabbage grew freely, but with all my care I could not succeed in keeping the ants and insects from it. I shall be thankful for any hints regarding its cultivation you can kindly give me"

From Mr. E. J. DeMeder, coffee planter, Kartary:

"The Cuzco maize seed you supplied me with last year was all put down in my estate at Kartary; every seed germinated to perfection, and the plants grew to about 6 feet high and the cobs were about a foot long and quite full. I had every hope of seeing a fine specimen of maize, and it was my intention to have sent you a few of the cobs when they were ripe, but unfortunately they were all stolen by some of the coolies and I could not get a single cob."

From E. C. G. Brace, Esq., Planter, Kotagiri:

"(a.) *Cuzco Maize.*—I sowed the first lot you gave me about the middle of last year. It grew remarkably well, and I have an average of two good cobs of seed to each plant; unfortunately they ripened their grain in the midst of the north-east monsoon. There is no doubt but it requires a well-worked and heavily-manured soil, if it is to be grown to advantage, and I think if sown so as to come into tassel at the commencement of the dry weather, then cut, dried and stacked as cholum stalks are in the low country, it would cut with an ordinary chaff-cutting machine and afford a large quantity of most nutritious food for cattle during the dry months of the year. I tried a small sowing with the two sorghums this spring, but Badaga cattle got in at it and never gave it a chance while there was a blade left; they *would not touch the sorghum* growing alongside. It struck me as resisting the drought better than common maize. I tried a sowing of *Sorghum saccharatum* and *Sorghum kaffrarium* in early spring; though constantly watered they did not make any satisfactory growth until the fall of the spring showers, and of course having been stunted at the outset, never came to much; at favorable seasons, say from April to November, and with deep cultivation and plenty of manure these fodder plants will grow well, but Guinea and Mauritius grass, ordinary Lucerne, or the new American variety will do much better at a far less cost.

"(b.) *New American Lucerne* (*Alfalfa*).—I put down a small patch of this with the very first showers in rows 9 inches apart and 6 inches in the rows. In spite of being constantly fed down by stray cattle it is doing well; when I grow it again it will be in row 18 inches at least apart and 1 foot in the row. It appears to me to bush out far more than the ordinary variety.

"(c.) *Santung Cabbage.*—With Cuzco maize grown, as I have above suggested, the *most useful* and the heaviest yielding plant yet introduced. Eaten greedily by horses, cattle, pigs, sheep, goats and poultry. I told you last year that I had grown them 4½ to 5 lbs., at 2' X 2'. This spring I grew two rows grown 18 inches apart and 1 foot between the plants. I pulled two average plants growing side by side and they weighed 8¼ to 8½ lbs. respectively; not the slightest doubt but that it stands dry weather better than any of the maizes or sorghums, and will give a remunerative yield even on *unmanured soil.* I am quite certain that in a *single* year heavy crops in succession of Buckwheat, Santung cabbage and Cuzco maizes could be taken off a plot of fairly well-cultivated land with ease. Buckwheat grows remarkably well with me here. I hope this season to commence the cultivation of 5 at any rate, but I hope nearly 20 acres of nearly flat land with fodder plants of all kinds, and in this case I shall be glad to have a little of your wheat-seed for trial. I should be very much obliged if you would get me a few sets of *Reana luxurians* for trial."

From J. Cameron, Esq., Superintendent, Government Botanical Gardens, Bangalore:

"I have the honor to submit brief report on the results obtained at Bangalore from the cultivation of the "Santung cabbage" of which you were good enough to present me with a packet of seed on the 22nd August, 1877. Small packets of the seed supplied were again distributed by me to Messrs. Nagapah and Moonesawmy, Florists at Bangalore, for trial in their gardens. My seeds were sown broadcast shortly after the date of their receipt, and they germinated in about eight days very profusely. The subsequent growth of the seedlings was rapid and vigorous, exceeding that of either lettuce or cabbage at the same stage. The young plants were transplanted into drills 2 feet apart to be finally tested as a culinary vegetable when full grown, but it occurred to me while this was in progress, that if the young tender plants were blanched in the same manner as Endive or sea-kale, an excellent salad would be produced. I regret, however, that more urgent work prevented me from carrying this experiment into effect. When the Santung cabbage were full grown (and they were very large resembling a gigantic Cos lettuce) we had them cooked in the same way as spinach, *i.e.*, minced up and boiled for a much longer period than cabbages generally are. I presented specimens to a few of the leading residents in Bangalore with directions to cook them like spinach, and they without exception pronounced the vegetable a success."

New Plants.—A considerable number of new and valuable plants have been added through exchange and purchase to the garden collection during the past year; the most important being a collection of upwards of sixty species and varieties of New Zealand ferns. These were purchased through Captain Campbell Walker from a nursery man in New Zealand, and with the exception of some tree ferns arrived here in excellent order, and are now established and growing well in the gardens.

A small packet of seed of the true *Cinchona Calisaya var: Ledgeriana* was received from Major Berkeley; from this seed 12 plants were raised. These have been increased by cuttings to 57; a portion of these have been promised to Major Berkeley, but I hope to increase the stock largely by cuttings, so that a good number of plants of this valuable cinchona may be available for distribution next planting season.

In the spring of last year a gentleman resident in Wynaad sent me a small case of Liberian coffee. As he had no experience in the raising of this coffee from seed, he asked me to germinate them for him in the garden propagating houses. This I agreed to do, and succeeded in raising 410 plants, 350 of which were sent to the owner. Of the remaining 60, 30 were planted in the Burliar Garden, 17 distributed to planters in different parts of the Presidency, and the remainder are now in the propagating-house in the gardens.

As directed by G. O., No. 3,060, dated 2nd October 1877, four Wardian cases containing economic plants, and one case of seeds were forwarded in March last to Messrs Nicol and Co., Bombay, for transmission to the Livingstonia Mission in Central Africa. The cases contained—

	Plants.
Cinchona Succirubra and C. Condominea	228
Tea Assam Hybrid	138
Coffee Arabica	100
Orange	6
Leechee	7
Nutmeg	2
Cinnamon	2
Jalap tubers	6
Ipecacuanha	12

in addition to a large parcel of cinchona and low-country seeds sent by Dr. Bidie. The gardens supplied seeds of twelve varieties of Australian Eucalypti and Acacia Jalap Taraxicum, Digitalis, Cuzco Maize, Santung Cabbage, Brazil Cherry and the Hill Guava or Goosberry. The plants and seeds were securely packed, and it may be hoped that the greater portion of them will reach Africa in good order.

A case of Neilgherri orchids, indigenous tree, and shrub-seeds, was sent to A. Lascelles, Esq., Wellington, New Zealand, in exchange for Araucarias and New Zealand plants and seeds.

A parcel of cuttings of Rheea (*Bohemeia nivea*) was supplied to the Madras Municipality for trial on their Sewage Farm.

Monsieur Pierre, Director of the Botanic Gardens, Saigon, visited the Ootacamund Gardens in December last, and was supplied with a complete collection of specimens of the different species and varieties of cinchona cultivated on the Neilgherries, also with a number of specimens of the indigenous shola trees.

A case of scions of the finest kinds of apples, pears and plums, cultivated in Australia was imported this season for the purpose of grafting stocks in the gardens, but unfortunately they were all dead when they arrived here, having been packed in too green a state. Another attempt will be made to introduce them this season.

The catalogue of timber trees, shrubs, and flowering plants, &c., for sale at the gardens has been carefully revised and 200 copies printed. They can be had gratis on application at the garden office.

Medicinal Gardens.—Early in 1877 proposals were made to Government by the Surgeon-General, Indian Medical Department, pointing out the desirability of establishing a garden for the cultivation of such medicinal plants as were likely to thrive on the Neilgherries, with a view to reducing the Home charges for drugs. Under G.O., No. 432, dated 3rd April 1877, funds were allotted and measures taken to start an experimental garden. For this purpose a piece of land adjoining the cinchona plantation at Dodabetta was taken up, fenced and drained, and is being planted up as fast as plants are available.

Operations were commenced by propagating the hardier kinds, *viz.*, Jalap, Peppermint, Digitalis, Rhubarb, Taraxicum, Lavender, Rosemary, and Ipecacuanha, the latter being propagated in the hot-house in the Ootacamund Gardens and planted out at Burliar.

(*a.*) *Jalap.*—The propagation of the Jalap plant has been carried on rapidly. At the outset the stock was comparatively small, consisting of a hundred large plants that were grown in the gardens for their flowers only. These plants were lifted, cut over, and the cuttings put in pots under glass, where they rooted rapidly. The number of young plants now planted out in the garden exceed 5,000, and I hope to have at least double that number planted out by the end of this year; 800 of the plants put out in June last have tubers averaging 1 lb. each in weight The original tubers, one of which weighed 15½ lbs., were sliced and dried. A sample of this dried root was sent to the Surgeon-General, Indian Medical Department, for trial in the Madras Hospitals. That gentlemen reported that the root was administered in the form of a compound powder, and in the dose prescribed in the Pharmacopœa for the Mexican Jalap root, and in twelve cases in which it was tried produced precisely similar effects. A 4 lb. sample of the same root was forwarded to London in January last, and has been most favorably reported on. There can be no question that the climate and soil of the Neilgherries is most favorable for the production of this medicine, and if a sufficient acreage is brought under cultivation we will be able to supply the whole of India with this drug at a much cheaper rate than what it can be purchased at in the English market.

(*b.*) *Ipecacuanha.*—The propagation of the ipecacuanha is being successfully continued as will be seen from the following figures. At the commencement of the year under report the entire stock of plants and cuttings in the propagating-house in Ootacamund was 2,698; these have been now increased to 6,956, *viz.*:—

Planted out in the Burliar Garden	2,900
Plants in pots at Ootacamund	3,000
Root, stem, and leaf-cuttings in do.	1,056
Total ...	6,956

which shows an increase in stock during the twelve months of 4,258 plants. The plants at Burliar continue to make a satisfactory growth, notwithstanding their having suffered from the extremes of drought and excessive moisture experienced during the spring and autumn of last year. The plants put out this season are being planted in the warmest and most sheltered parts of the garden.

(*c.*) *Peppermint.*—The area at present under peppermint is not so large as I expected, in consequence of an error having been made at the outset in the propagation and planting of what was believed to be the true peppermint, but which turned out to be another variety of mint. Plants of the true *Mentha piperita* having been secured, upwards of 2 acres have already been planted with it, and as it can be rapidly increased by division of the roots, the acreage under it will be largely extended during the year.

(*d.*) *Rhubarb.*—Our stock of this plant is still very limited. The older plants not having yet produced seed, the propagation has been confined entirely to of-sets from the parent roots.

(*e.*) *Digitalis and Taraxicum.*—Two plots of ground have been planted with Digitalis and Taraxicum sufficient to supply the annual demands of the Medical Department. These plants grow very freely in Ootacamund, and require but little care or cultivation.

(*f.*) *Rosemary and Lavender.*—Several thousand young plants of each have been propagated in the garden nurseries and will be put out in the medicinal garden in October next.

Drugs supplied.—Sixty-five lbs. of Berberis cortex and 62 lbs. of Digitalis folio were supplied to the store-keeper, Indian Medical Department, during the year. Of these drugs we have now in store 15 lbs. dry Jalap root, 50 lbs. Digitalis folio, and 5 lbs. Taraxicum root. Surgeon-Major Bidie, M.B., was supplied with small samples of the following drugs grown in the Ootacamund Garden for transmission to the Paris Exhibition:—Digitalis Taraxicum, Peppermint oil, Rhubarb, Jalap, and Berberis cortex.

A large number of recently imported Australian and New Zealand trees and shrubs have been put out in the Park Many of these thrive much better in Coonoor than in the Ootacamund Gardens. Fifty plants of the valuable cinchona calisaya received from the Assistant Superintendent, Neddivuttum Plantations, will be planted in a sheltered corner of the Park in October next. As cuzco maize thrives splendidly in Coonoor, a small quantity is grown annually to raise seed for distribution.

Burliar Garden.—The nurseries in this garden have received special attention, and are now large enough to admit of a constant supply of young spice and tropical fruit-trees being raised to meet the increasing demand from planters and others for such plants. 289 plants of various kinds were sent out, and the nurseries contained 1,213 seedlings on the 31st March last. This number will be largely augmented during the current year.

To prevent over-crowding, several large Jack trees were cut down and replaced by cocoa, mangosteen, and other more valuable plants.

The West African coffee plants continue to grow luxuriantly, and are evidently quite at home in the climate of Burliar. The largest plant is now upwards of 8 feet high, and is bearing a good crop of plump, healthy berries. Thirteen plants were raised from some seed yielded by this plant last year From information I have received I believe Liberian coffee has not been a success in Wynaad, except where it has been planted in warm, sheltered localities. That it will not grow, much less thrive, in the elevated districts in which the coffee Arabica flourishes, is a point now fully settled. It requires a very much warmer climate than that variety, and in my opinion cannot be grown successfully in Southern India at an elevation over 2,500 feet Our plants were badly attacked by leaf rust in the autumn of last year, but this disease does not seem to affect the health of this plant to the same extent as it does the common variety.

Some hundreds of young plants of *Pithecolobium samon* or rain tree has been raised from a packet of seed received from the Conservator of Forests.

The Mahogany plants put out last year are making a healthy growth, the largest plants now being over 5 feet high.

Cocoa (*Theobroma Cocoa*). In consequence of light crops and a succession of bad seasons in the coffee districts of Southern India, it is not surprising that planters and others are now turning their attention to the cultivation of cinchona, cocoa, and other plants that many prove an equally remunerative and less precarious investment. That cocoa will flourish in many of the coffee estates at elevations from 1,000 to 3,000 feet in Wynaad and Coorg, I have not the least doubt. It might be planted with advantage between the rows of coffee bushes and in avenues along estate roads. In the spring of last year, I distributed gratuitously a number of plants and seeds to planters, who find it thrive and are now anxious to obtain large supplies of plants. Already several thousand seed have been sent to estate proprietors in Mysore, and I have registered orders for the whole crop of seed that the trees at Burliar will yield this season.

The mangosteen trees blossomed very profusely last year, and are now bearing a heavy crop of fine fruit, a small proportion of which will be reserved for seed.

Kulhutty Garden.—The garden at Kulhutty was visited by the Superintendent four times during the year. His Assistant (T. Burrows) was also sent out several times to inspect work, sow seed, and graft fruit-trees. The privilege of collecting and selling the fruit in this garden from August 1877, to 31st March 1878 was put up to auction at the Commissioner's Office and realised Rs. 601.

A good stock of young fruit-trees has been maintained in the nurseries throughout the year. A few pounds each of Sorghum, Planters' Friend, English wheat, and barley have been sown in this garden, simply to keep up a supply of these grains for distribution.

The jalap tubers, rhubarb, and other medicinal plants planted last year at Kulhutty have not thriven so well as at Ootacamund; their cultivation will, therefore, not be continued.

The apple, pear, orange, and other fruit-trees have become so badly affected by parasites that they will soon cease to yield fruit. If it is considered desirable to maintain a fruit garden at Kulhutty, the whole of the old trees should be up-rooted and healthy young trees planted in their places. But as all the fruit-trees and plants cultivated at Kulhutty can be grown equally well at Coonoor, would respectfully beg leave to recommend that the former garden be abandoned and sold. I have no doubt but it could be readily disposed of to one or other of the planters whose coffee estates adjoin the garden. The amount realised by the sale might with advantage be expended on the erection of a permanent fence and the formation of nurseries in Sim's Park at Coonoor.

FORESTRY.

SOME months back the Inspector-General of Forests under the Government of India, forwarded to England through one of the Calcutta agency firms a supply of woods, the residue of the collections prepared for exhibition and other purposes to test practically the value of these woods for carriage building, furniture, turning and other work. Messrs. Mackenzie Lyall & Co. undertook to send the supply and signified their willingness to send further shipments either from Rangoon, Moulmein, or Kurrachee. The woods were offered for sale by Messrs. Churchill, of London and some of the lots realised good prices; specimens of boxwood realised as high as £7 per ton, and if there had been competition, higher prices would probably have been obtained. The Inspector-General of Forests is of opinion that the Conservators of Forests in the presidency towns may, with advantage make selections of woods for transmission to England.

WE learn from Rangoon that the Forest Department contemplate establishing an office and an experimental garden to be conducted on the same principle as the Magagyee plantation at the new head-quarters of the Tharrawaddy district. An Assistant Conservator will be placed in charge as soon as the services of one are available.

THE report for the Tenasserim circle of the British Burmah forests contains an interesting account of the Akyaw or eagle-wood which grows on the islands of south Tenasserim, the produce of *Aquilaria agallocha*, a large tree with a white soft wood. The eagle-wood is found in old trunks, in the midst of decayed wood, forming irregularly-shaped lumps of hard and scented wood. It is collected by the Selungs, chiefly between April and July, and is sold to Chinese traders. The quantity collected annually is

estimated at 1,000 *viss*, valued at Rs. 10,000. The destruction of these trees is considerable, and it has not yet been possible to take steps to protect them.

DESTRUCTION OF TREES BY FUNGI.—The following suggestive paragraph occurs in a letter on Continental Science in the *Madras Mail* :—

In the Cevennes, Upper Italy, Bayonne, and even the Azores, the chestnut trees, which are veritable "bread-fruits" for the population, are dying off; the most vigorous in the course of two or three years. The branches wither from the tips, and a dry-rot eats inwards towards the trunk. Around the roots is a kind of humid gangrene, giving off a liquid which blackens the soil; this inky color, however, may be produced by the tannin, which the tree contains, coming in contact with salts in the soil. On close examination, a fungus, or mushroom, will be found to have entwined itself round the roots, stretched its filaments in the new wood of the trunk and branches. The malady is contagious and re-calls the mulberry disease of 50 years ago. Now all these symptoms coincide with the premature death of the trees on the Boulevards of this city; and beneath the grating, which runs around the trunks, quite a "bed" of venomous mushrooms are even to be found. The usual explanation given for the perishing of the trees in Paris is, the gas pipes and the shaking of the ground by the passing vehicles.

IT is stated that the newest financial project of Russia is in the form of a concession for a term of years of all the State forests to a joint stock company, who will have the exclusive right of cutting and selling timber from those sources in return for a stipulated royalty, to be paid annually to the Government. Among other conditions of the concession, the Company is held bound to re-plant woodlands that have been already denuded by injudicious forestry or by theft, and to conduct their own felling operations with due regard to the interests of the future.

MAHOGANY SEED.

THE following letter was addressed by the Conservator of Forests to the Madras Government on the 16th November last :—I have the honor to inform you that I am of opinion that the Mahogany seed should be forwarded direct from Jamaica or the Bahamas; it should be removed from its capsules and packed in perfectly dry silver sand, or in perfectly dry saw-dust and charcoal-dust mixed; there should be no unavoidable delay in its transport. The box should be addressed to the Conservator of Forests, Madras, and be labelled *Mahogany Seed*, and there would be a better chance for a greater retention of vitality if the box came *viâ* Bombay instead of Madras. On a former occasion a large box was sent, I think, from Jamaica; the large round fruits or capsules had been packed whole with the seed in them, and when opened were found to have quite rotted away, and I afterwards heard that the box had been detained many months in England. It would be too expensive to think of getting live plants down from Calcutta, and far preferable to procure the seed direct than to indent on supplies that had gone first to Calcutta. His Excellency the Governor of Jamaica will be addressed in view to a supply of Mahogany seed preserved and packed in the manner indicated being sent direct to this Government by Mail Steamer *viâ* England and Bombay to Madras.

MINERALOGY.

A CORRESPONDENT of a Madras newspaper has been making a tour of inspection through the gold fields of Wynaad, and in the course of his travels was introduced to Mr. Brough Smythe, and his practical miner, Mr. Laing, who he says came to India to determine whether payable gold is or is not to be found in this country; and they have settled that question beyond dispute. "There is gold and rich gold, but India will never be a mining country like Australia, and for this reason, it can never be properly prospected. It may be asked why it can never be prospected; the answer is very simple, it is broken up into too many proprietorships. What with rajahs, zemindars, and planters, men whose profession and livelihood is gold-digging will never come out here to prospect, *because there are no mining regulations*. One of the first things Mr. Laing said to me was "India can never be like Australia because there are no miners' rights." That has been my impression all along and I told him so. If the gold industry in India is intended to be developed for the benefit of the many instead of the few, then mining rules should be drawn up and copies forwarded to the "Mining Departments" in the various colonies for publication. Of course landholders will do all in their power to oppose this, as they will say the mining rights are already theirs. But they will find it far more difficult to raise capital to work mines in India than it would be in any other part of the world. Both Mr. Brough Smythe and Mr. Laing agree that some of the gold that they have found is far richer than anything of the kind they ever saw in Australia and they showed me some enormous quantities of very rich specimens. They neither of them believe much in Wynaad as an alluvial digging except on Vellera Mullah, which I mentioned in my last as giving good indications of alluvial gold."

PROFESSOR Mendleeff disputes the accuracy of the view generally held, that mineral oils result from the decomposition of organic substances, on the ground that no Devonian or Silurian deposits are met with in Pennsylvania, and that consequently such oils must have been formed in still older strata, which contain little or no organic remains. He believes that in the centre of the earth there is an enormous mass of metal, and especially of iron, more or less carbonated, and that these metallic carburets are decomposed under the influence of water, heat, and pressure, giving rise to the formation of metallic oxides and hydrocarbons.

A MANILA newspaper announces the discovery of a mine of *Amianthus*, or earth flax, in the island of Luzon. Several specimens of that mineral have been sent to Manila and shown to different qualified persons who have pronounced it to be of excellent quality.

THE IRON WORKS AT WARORA.

AN article that appeared in the *Pioneer* some weeks ago contrasted the success attained by the Bengal Iron Works Company, in the manufacture of iron on a commercial scale, with the complete failure of the Government Works in Kumaon, and with the not very successful results of Government enterprise in the same line at Warora in the Central Provinces. We were then inclined to attribute the partial failure of Mr. Ness's experiments to the fact that he was a Government servant, and therefore probably to some extent hampered by official rules and red tape; whereas, the manager of the Bengal Works had only to do what he considered best, and render an account of his stewardship to the company that employed him. This theory, however, appears to have done injustice to the Government of the Central Provinces; for, on searching through the notices of the Warora Iron Works, that are published in the official reports of the Public Works Department, we find that every facility has been given to Mr. Ness to pursue his experiments in his own way, and that his failure to produce pig iron by the usual process must be attributed to the imperfect nature of the materials he had to work with, the want of experienced assistants, and the circumstance that his whole time and attention could not be given to the iron-smelting experiments alone, the management of the Warora Colliery being also in his hands.

Of the three raw materials required for the production of cast-iron—ore, limestone and coal or coke—only the last is of a poor quality in the Central Provinces, the limestone of Bailgaon and Kundalla being very good, and the ore by all accounts only too rich. The following tables give a comparative view of the compositions of the iron-ore and coal employed in two places where cast-iron has been successfully manufactured, and at Warora, where the manufacture of this form of iron has been a failure. No. I represents Derbyshire clay ironstone (calcined) and Derbyshire coal as employed before the introduction of high furnaces and coke fuel; No. 2, the raw materials employed in the Raneegunge coal field; and No. 3, the materials employed at Warora. The limestone used may be considered nearly equal in quality, that employed in Bengal being the worst :—

Ore	No. 1	No. 2	No. 3
Oxide of iron	60	66	95
Silica	26	10	5
Alumina	7	7	traces.
Lime, potash, Phosphoric acid, carbonic acid, &c, ...	7	17	—
	100	100	100

Coal	No. 1	No. 2	No. 3
Fixed Carbon	67	56	56
Volatile combustible matter	23	23	20
Water	8	4	10
Ash	2	17	14
	100	100	100

It is evident from these figures that the iron-ore of Lohara and Pipalgaon, used at Warora, is immensely superior to either of the other two, being, in fact, nearly pure magnetic oxide, whilst the coal is superior to that of Raneegunge, in-as-much as it contains less ash. The worst quality about the Warora coal is the large proportion of water it contains; but in Mr. Ness's opinion the greater part of this is only held mechanically, as in a sponge, and will disappear when the mine is better drained.

Considering the excellence of all the materials employed in the Warora experiments, so far as can be judged from their chemical composition, it is natural to inquire why iron has not been successfully obtained from them on the large scale. The answer would appear to be that the Warora coal has one great defect that does not appear in an analysis table—when heated it decrepitates and crumbles to powder—and that possibly the assistance of an experienced furnace-man in constant attendance would have rendered the experiments successful. Another point to be borne in mind is that the blast furnace in its present form has been evolved from the experience of generations of iron smelters, who worked with the poor clay ironstones of the English coal measures, and that, therefore, in principle it is presumably better adapted to the reduction of poor ores like those of Raneegunge, than of the rich oxides found in the Central Provinces. Mr. Ness's furnace was a little one, twenty-five feet high, with three twyers or blowers. The blast was heated and driven in under a pressure of about three pounds to the square foot. The coal with which the furnace was charged was found to burn away rapidly, and the ore was reduced to metallic iron at a comparatively low temperature. The mass of metallic iron, instead of combining with carbon from the heated coal or the furnace gases, to form the fusible mixture called cast-iron, settled down on the hearth of the furnace in the solid state, and though the temperature in front of the twyers was raised to the point at which the firebricks began to soften, the mass of iron refused to melt. Now in a discussion of these experiments, it appears to have been the opinion of a distinguished English ironmaster that success would probably have been attained if a somewhat larger furnace had been used, with a blast pressure of twelve pounds or so to the square foot, sufficient to force the air up through the mass of materials filling the furnace instead of allowing it to be wasted about the twyer holes, *and if the furnace had been charged at first with a poor material* (a mixture of clay and limestone with very little ore) so as to form a large quantity of fusible slag, through which the spongy iron might descend slowly, absorbing carbon on its way.

It would, however, be almost an insult to the pure ores of Lohara to treat them in this way, and we therefore think that Mr. Ness was quite right to abandon the attempt to make cast-iron and go in for the production of malleable iron and steel by a direct process. That he has been perfectly successful in this, so far as metallurgical processes are concerned, our readers are already aware. It remains to be seen whether the manufacture will pay commercially.—*Pioneer.*

THE WYNAAD GOLD FIELDS.

MR. BROUGH SMYTHE has submitted to Government a further report on his explorations at Devalah and other parts of the Wynaad. He writes :—"As early as possible after the date of my last report I caused mining operations to be carried on in an adit near Wright's level, north of and, about 30 feet below the point where the rich auriferous quartz occurs, and in a sinking about 3 feet, stone has been obtained in which much gold is visible. Quartz from this adit, in which no gold was to be seen, has yielded at the rate of 2 oz. 11dwt. 18 5 grs. per ton. The old adits made by the natives in one portion of the cavern reef have been cleared, and gold is to be seen in the 'casing' of the reef ('hanging wall') The yields lately obtained from this reef have been as follows :—

	OZ.	DWT.	GRS.	
Quartz, no gold visible ...	0	11	15·5	per ton.
'Casing,' small particles of of gold to be seen	0	11	16	„

The native miners appear to have taken stone principally from the 'foot wall.' This reef will be further tested in sections. A vein of quartz near the Prince of Wales' reef has been opened, and the only parcel of quartz yet treated has yielded at the rate of 17 dwt. 11·77 grs. per ton. Further trials of the stone from this locality will be made shortly. Quartz broken out of the Korumbar reef, the outcrop of which is about twenty-two chains north-easterly from the cavern reef, has yielded at the rate of 1 oz. 0 dwt. 1·15 grs. per ton. A reef south of the road from Nelakotta to Sultan's Battery has been partially explored, and some of the stone has been tested, but only a minute quantity of gold was found—not a weighable button. All the soils in the vicinity of the reef yield gold by washing, and it is certain that if mining operations be pursued, the 'run' of gold will be found in the reef. Other reefs in the neighbourhood of Devalah and north and east of Devalah are being opened. On the 9th November I went down the Carcoor Ghat. At a point about 1,900 feet below Devalah, I found a thick reef in the jungle; and at Karambaut, in the Kaleikapoya, about 2,600 feet below Devalah, there is a large area which has been worked by the natives; and on the hills, for a distance of a mile or more, there are blocks of quartz indicating the occurrence of a reef of enormous thickness. Soil taken from the bank of the stream was washed and gold was found, and the Korumbars made a sluice (not down to the bed-rock), and they also got gold. Subsequently I had stone broken out of the reef at various points; and on returning to the camp Mr. Thomas Laing washed some of the broken quartz and found gold. The yields have varied from a mere speck of gold to 9 dwts. 11·13 grs; 17 dwt. 23·38 grs.; and 1 oz. 4 dwt. 14 grs. per ton. Near Murada, about 2,750 feet below Devalah, there is a large vein of quartz outcropping in the stream, and there are two reefs parallel to the main reef-the one about five chains and the other about seven chains north-easterly from the stream. The main reef is traceable for more than a mile-and-a-half. The Korumbars inform me that these reefs have never been worked by the natives, nor have they washed the soils for gold. I took samples of stone from each of the reefs, and, I found a few minute specks of gold in each. A little less than one mile south-west of Eddacurra, more than 2,800 feet below Devalah, there is a strong outcrop of quartz. The stone has yielded a little gold. On the road from Eddacurra to Nadukani three large reefs and numerous small 'leaders' were seen. Not much progress has been made with the survey of this district during the past month; my visit to Eddacurra, the testing of quartz, and other urgent work having occupied a great deal of my time. With the permission of his Grace the Governor, I propose to visit Charambadi and Vellirymalla next week, in order that I may gain some knowledge of the rocks and veins in the western part of the district; and on my return I shall devote myself wholly to the completion of the map and the examination of the reefs in this area."

IRON IN THE SIMLA HILL STATES.

IRON is found chiefly in the British tahsil of Kotekhaie, and the native States of Bissahir and Jubal.

In Kotekhaie the mines are situated on two different mountain spurs close to each other.

The first—known as MOLTANN is near the village of Trola, about 6 miles N. E. of the dâk bungalow at Kotekhaie.

The second-called TUMBARAN is at the foot of the village of Degwari Jubal.

At the former there are three extensive subterranean galleries from one of which the natives draw their mineral, whenever they can procure charcoal for its manufacture. The iron is procured in grains, (like sand) from a micareous schistose matrix thickly encrusted with small (imperfect) garnets. Though the surface schists are ferruginous, they are less so than those extracted from the interior of the hill, which are much softer in composition and are more easily reduced to powder, due to their being permanently exposed to damp which greatly assists in their disintegration.

The ores yield magnetic oxide of iron as follows :—

Moltann	19·33 per cent.
Tumbaran	28·47 „ „

This difference, though, does not prove that the latter is richer than the former, but more than likely is owing to the variableness of the specimens.

The iron is smelted in April-May, after the snow is melted, and again from September-November. During the rainy season the manufacture is stopped.

The mines are worked by running a horizontal shaft, only 3½ feet in diameter, into the side of the mountain: the schistose matrix, containing the iron grains, is brought out in skins, reduced to a fine powder, washed in the stream, and the grains of iron smelted. When reduced into small pigs, it is again put into the fire, and hammered until it becomes malleable. All these processes are performed on the spot. The furnaces are nothing more than large clay crucibles, about three feet high, not unlike two inverted cones the diameter in the centre being about eighteen inches. There are two holes at the bottom, for the insertion of the nozzles of two bellows The crucible, being placed over an ash-hole, is filled with grains of iron (ore), fire applied, and the bellows worked. When sufficiently fused, an iron rod is struck though the bottom of the crucible, upon the withdrawal of which, the impurities run into the ash pit, leaving the iron in the crucible.

The tools employed resemble somewhat those sketched in Colonel Yule's *Note on the Iron of the Kasia Hills*, in vol IX, page 857, of the Journal of the Asiatic Society Bengal.

About three hours walk from the foregoing mine, are those of SHEEL in the native territory of Bissahir, Here the ore occurs in talcy schists, it is the same as the Kotekhaie description in all other respects: as also the manufacture.

There are about a dozen small smelting furnaces, worked to suit the convenience of the work people (who are also small farmers), though for the Rajah's profit.

Here, most of the tools used in constructing the Hindostan and Thibet road, were manufactured under the superintendence of Captain D. Briggs.

About two thousand maunds (80lbs, to md.) of iron are exported annually from the mines of Kotekhaie and Sheel to Simla and the plains; some to Thibet *viâ* Rampore.

Another three hours walk from Sheel brings the traveller to the small rest house in Deora, in the native territory of the Rana of Jubal.

In this territory the iron occurs in three hills named Jachali, Panati, and Praonti. Proceeding from Deora in the direction of Kotekhaie, and about six miles off is JACHOLI on the right of the road, on the left is PRAONTI, while PANATI is on the slope facing Jacholi.

There are about a couple of dozens of smelting furnaces, but owing to a scarcity of fuel they are worked at irregular intervals.

The ores yield magnetic oxide of iron as follows:

Jacholi	19 to 33 per cent.
Praonti	20 „ 25 „
Papati	17 „ 22 „

Reckoning two maunds of charcoal as being necessary to the production of one maund of pig iron, it gives an annual consumption of 4,000 mds. of charcoal for the production of the 2,000 mds. of iron before alluded to: 4,000 mds. of charcoal represent 20,000 mds. of wood, equal to 2,000 trees—at which rate per annum the districts are being denuded of their arborescent covering without any means being adopted to reboise them. The forest revenue is almost *nil*, and the supervision (in Kotekhaie) corresponds. With a good system of forest conservancy, notably a proper course of felling by rotation and rest, and a resident European Forest official, these ferruginous districts would yield a large quantity of iron, and could then be profitably worked under skilled European superintendence.

The Rajah of Sirmoor established, sometime ago, a large iron foundry at his capital of Nahun, but owing to a want of judicious management it has come to nothing. It seems to have been treated as a fog with the ordinary result of such treatment. Under proper supervision the foundry and workshops could have become of great benefit to the neighbourhood for many miles round.

The pig iron costs from six pice to two annas a seer (2 lbs. av.) at the works. About one-third loss occurs on working the pig into tools or in refining. The hire of a mule carrying 2½ mds. (200lbs) costs 12 annas a stage. Tools for digging cost from 5 to 6 annas a seer.

The mines are situated 35-43 miles E. of Simla; the marches being SIMLA to FAGU, 11 miles, dâk bungalow establishment and provisions; Sainj, 7 miles, no accommodation; KOTEKHAIE, 14 miles., dâk bungalow, but without any establishment; DEORA, 11 miles, rest-house, but no establishment: provisions and luggage coolies procurable at all the stages.

G. P. P.

The Planters' Gazette.

TEA.

THE imports, stocks, and deliveries of Indian tea from 1st January to 30th November, stands as follows for the years respectively mentioned:—

	1875. lbs.	1876. lbs.	1877. lbs.	1878. lbs.
Import	22,306,000	25,844,000	28,458,000	30,239,420
Delivery	21,262,000	21,782,000	25,533,000	34,180,950
Stock	8,190,000	10,280,000	14,496,000	11,142,280

Thus the increased import in London since 1875 is 7,933,420. It will be seen that while the deliveries showed an increase in 1878 over the previous year of 33 per cent., the imports give only an increase of 6 per cent., and it is hardly likely that the subsequent shipments will bring stocks in hand up to as high a figure as the previous season's returns showed.

NATIVE TEA GARDENS.

WE are extremely glad to see native enterprise spring up in the cultivation of tea. We have heard of several new gardens being opened in Assam and Cachar by natives, and we personally observe that a good number has been started and managed by natives in the Darjeeling district. Amongst them we feel great pleasure in noticing to-day the plantation of the "Hindoo Tea Co., Ld.," which has been opened in the Terai by a number of young and energetic Hindoo gentlemen. In the last season an area of 60 acres was planted, and the Company has arranged to extend 40 acres more in the coming season. A plantation of 100 acres is of course of some worth, and it will be a credit to the Company if they can manage it with the present number of paid-up shares.

For some time past we heard a complaint against the management, but we are now glad to see that the past management has been done away with, and the business of the Company is now in the hands of a Secretary who is an intelligent practical man and has taken up the work in right earnest. The present Manager is said to have vast practical experience in tea. The budget of expenditure for the coming year framed by the new Secretary and Manager which is now in our Press, reflects much credit, and shews how economically the natives can manage such affairs.—*Darjeeling News.*

TEA STATISTICS, 1876-77.

(RESOLUTION BY THE GOVERNMENT OF INDIA.)

IN 1872, the Local Government and Administrations were asked to prepare statements illustrative of the position of tea cultivation in India. The statistics which were furnished in reply to the request then made were so much delayed that, having regard to the rapid development of the industry, they were of but little value by the time the whole of the replies had come in. The Governor-General in Council considered last year that it was desirable, in view of the great extension of this industry, that the Government and the public should be possessed of statistics showing its actual condition in each province of the empire from year to year; and, accordingly, a circular was issued in May 1877, requesting that the tables circulated in 1872 (the forms being, however, materially simplified) might be filled up for the last two official years. A similar return for coffee cultivation was also asked for.

2. The replies to this circular have been greatly delayed, but are at last complete. The returns from Assam for tea, and from Madras for coffee, were particularly late; and as the production of tea in Assam, and of coffee in Madras, is larger than in any other province, the delay in both these cases is much to be regretted. It is hoped that, in future, earnest efforts may be made to transmit these returns within the time prescribed, *viz.*, in three months after the expiry of the year to which they relate.

3. The figures furnished by Local Governments have been thrown into two general comparative returns for 1875-76 and 1876-77: one relating to tea, and the other to coffee cultivation. Copies of these returns will be forwarded to her Majesty's Secretary of State for India, in compliance with his Lordship's request, and the returns will be published in the volume of miscellaneous statistics relating to British India, which is about to be issued by this department.

Copies of the returns will also be forwarded to the Local Governments and Administrations, through whom the figures from which they have been compiled were furnished.

4. The returns are defective in several points, as shown in the foot-notes appended to them, and in the returns themselves. The Governor-General in Council invites the attention of the Local Governments and Administrations to these defects, and will be glad if they will correct and complete the returns, so far as may be possible, excepting in regard to columns 13 and 14 of the tea statement, the information given in which is not now required.

5. It has been represented that considerable difficulty has been experienced in obtaining from planters the information required for the preparation of the tea return. This difficulty is possible caused by planters not knowing why the information is wanted, and not being assured that the figures they may furnish regarding their own estates will be kept private. The Governor-General in Council desires that the Local Governments and Administrations will be good enough to cause it to be explained, in future, to all planters from whom information may be sought, that the statistics are required for the preparation of returns for the whole of India, similar to those which have now been prepared; while all information given as regards particular plantations will be regarded as strictly confidential, no use being made of it except as material for the compilation of the general returns. Copies of the returns which accompany this Resolution should be sent with a copy of the Resolution to each planter from whom information has been received, in compliance with the requests made by Local Governments, and copies should be sent regularly to all those from whom information may be obtained in future. With this explanation of the objects sought by Government, and with the omission of the columns above specified, it is hoped that any objections to the communication of information which may have hitherto been entertained by planters will no longer be felt, and that they will cordially assist in rendering the returns accurate and complete, and in enabling the Government of India to issue them promptly and punctually.

6. In letter No. 1,183, dated the 28th March 1878, the Government of Bengal ask for further instructions in regard to the preparation of future returns of tea cultivation. The points on which instructions are desired relate to the figures to be entered in columns 5, 6, 13, and 14 of the return. As regards columns 13 and 14, it has already been said that they may be omitted from future returns. In regard to columns 5 and 6, the way in which these should be filled up has been defined in letter No. 448, dated the 25th October 1877, *viz.*, that tea plants should be considered "mature" when three years old, and "immature" before they reach that age. This definition should be adhered to.

7. The Government of Bengal also state that it is inconvenient to prepare the returns for the official year, and suggest that they should in future be made out for the calender year. The Government of India have no objection to this being done; and future returns, for both tea and coffee cultivation, may be made out for the calendar year.

8. Returns of tea cultivation in the North-Western Provinces and British Burma, and of coffee cultivation in Coorg, for the official year, 1877-78, have been received. Returns of tea cultivation in Assam, Bengal, the Punjab and Madras, and of coffee cultivation in Madras and Mysore, are still due; and the Governor-General in Council requests that they may be furnished at the earliest possible date. Where information has already been collected for the official year, the returns may on this occasion be made out for that period.

Statement illustrative of the state of tea cultivation in British India, during the official years, 1875-76 and 1876-77.

Province and District.	Number of plantations.		Approximate average elevation.	Area in Acres. Under mature plants.		Under immature plants.		Total area under tea.		Taken up for planting, but not yet planted.	
	1875-76.	1876-77.		1875-76.	1876-77.	1875-76.	1876-77.	1875-76.	1876-77.	1875-76.	1876-77.
2	3		4	5		6		7		8	
Assam †			Feet.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Cachar	162	162		24,662	28,837			24,662	28,837	117,207	121,074
Sylhet	11	25		2,267	5,621			2,267	5,621	4,669	21,583
Goalpara	7	8		79	112			79	112	75	1,085
Kamrup	53	72		4,099	5,078			4,099	5,078	13,717	13,040
Darrang	95	95	*	9,615	10,935	Included with mature plants.		9,615	10,935	41,078	40,191
Nowgong	49	51		5,929	6,593			5,929	6,593	11,869	14,568
Sibsagar	151	172		27,483	28,690			27,483	28,690	92,159	85,446
Lakimpur	109	112		12,788	16,036			12,788	16,036	80,341	75,457
Khasi and Jaintia Hills ...	8	5		435	804			435	804	278	458
Total ...	640	702	......	87,307	102,711	...	...	87,307	102,711	361,393	872,849
Bengal.											
Darjeeling‡	121	132	300 to 6,500	14,954	15,695	7,208	9,333	22,162	25,028	79,113	84,609
Julpigoree	3	13	500 to 600	...	23	288	795	288	818	1,453	3,395
Dacca	6	6	13 to 21	29	29	3	2	32	31	...	...
Mymensing	2	2	1 to 4	54	53	...	...	54	53	...	...
Chittagong§	19	20	40 to 500	936	826	699	1,072	1,635	1,898	24,724	13,497
Noakholly	1	1	40 to 50	15	15	1	1	16	16	8	8
Chittagong Hill Tracts ...	4	1	30 to 200	439	220	613	230	1,052	450	286	2,106
Hazareebagh	3	3	2,177	647	668	72	50	719	718	...	...
Lohardugga	11	21	*	240	320	180	910	420	1,230	1,234	2,276
Total ...	170	199	......	17,314	17,849	9,064	12,393	26,378	30,342	106,818	102,891
North-Western Provinces.											
Kumaon ‖	13	19	3,000 to 6,400	1,456	1,457	755	765	2,211	2,222	1,699	1,689
Garhwal ‖	1	4	6,000	13	13	...	...	13	13	...	...
Dehra Dun	13	16	1,849 to 2,500	1,687	1,874	452	600	2,139	2,474	1,949	1,780
Total ...	27	39	1,849 to 6,400	3,156	3,344	1,207	1,365	4,363	4,709	3,648	3,469
Punjab.											
Simla	1	1	*	120	120	...	...	120	120	...	...
Kangra	850	910	3,969	2,579	2,789	1,547	1,822	4,126	4,611	1,201	1,773
Total ...	851	911	......	2,699	2,909	1,547	1,822	4,246	4,731	1 201	1,773
Madras.											
Nilgiris	38	44	3,500 to 8,000	1,514	1,514	878	1,628	2,392	3,142	641	2,841
British Burmah.											
Akyab	1	1	60	120	120	30	30	150	150	100	100
Total British India ...	1,727	1,896	......	...	...	...	...	124,886	145,685	473,801	48[illegible],428

* No information available.

† For 165 plantations in 1875-76 and 146 in 1876-77 the figures are merely estimates, no returns having been received from the managers. The figures in column 12 are not trustworthy owing to want of complete figures for the area of land under mature plants.

‡ The figures from this district are for the calendar years 1875 and 1876.

‖ Not including some plantations existing in 1876-77 for which no returns have been received.

§ The figures for 1876-77 are exclusive of 6 plantations in the Kumaon District and three in the Garhwal District.

Note.—The figures in column 12 do not in all cases correspond with those obtained by dividing column 5 into column 11, owing to errors in the local returns from which this table has been compiled.

Statement illustrative of the state of tea cultivation in British India, during the Official years, 1875-76 and 1876-77—*(continued.)*

Province and District.	Approximate yield in lbs. — Black. 1875-76.	Black. 1876-77.	Green. 1875-76.	Green. 1876-77.	Total. 1875-76.	Total. 1876-77.	Average yield in lbs. per acre of mature plants. 1875-76.	1876-77.	Cost of cultivation per acre. 1875-76.	1876-73.	Cost of manufacture per lb. 1875-76	1876-77.
	9		10		11		12		13		14	
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	RS. AS. P.	RS. AS. P.	RS. AS. P.	RS. AS. P.
ASSAM †												
Cachar					7,238,213	7,191,809	295	249				
Sylhet					173,026	673,466	76	120				
Goalpara					5,247	7,204	599	64				
Kamrup					544,699	664,675	205	221				
Darrang	*	*	*	*	2,245,344	2,800,854	358	412	*	*	*	*
Nowgong					886,094	1,105,517	140	168				
Sibsagar					6,428,881	7,226,663	234	251			*	
Lakhimpur ...					2,497,130	3,786,083	193	199				
Khasi and Jaintia Hills					12,806	87,328	28	203				
Total ...	...	...	...	...	20 028,890	23,493,099	229	228	...	...	...	...
BENGAL.												
Darjeeling‡... ...	4,610,758	4,181,622	...	..	4,610,758	4,181,622	269	218				
Julpigoree	5,600	29,520	...	...	5,600	29,520	...	240				
Dacca	4,660	3,722	...	...	4,660	3,722	161	128				
Mymensingh ...	5,371	3,517	...	...	5,371	3,517	100	66				
Chittagong§ ...	*	*	*	*	*	*	*	*	*	*	*	*
Noakholly	320	520	40	80	360	600	20	40				
Chittagong Hill Tracts	160,760	46,571	...	...	160,760	46,571	366	211				
Hazareebagh ...	93,051	47,717	1,783	...	94,837	47,717	144	71				
Lohardugga ...	58,880	67,610	...	...	58,880	67,610	215	230				
Total ...	4,939,403	4,380,799	1,823	80	4,941,226	4,380,879	285	245	...	...	...	...
NORTH-WESTERN PROVINCES.												
Kumaon ‖	94,551	64,104	183,871	196,956	278,422	261,060	183	169	60 12 10	62 10 1	0 5 8	0 5 8
Garhwal ‖	4,648	4,891	...	...	4,648	4,891	357	376	56 13 0	66 0 0	0 1 9	0 2 4
Debra Dun ...	202,112	358,812	146,000	74,400	348,112	433,212	194	217	78 13 4	60 3 2	0 8 8	0 3 6
Total ...	301,311	427,807	329,871	271,356	631,182	699,163	245	251	65 7 4	62 15 1	0 3 7	0 3 10
PUNJAB.												
Simla	*	*	*	*	8,170	7,484	68	62	*	*	...	*
Kangra	550,429	585,213	121,350	137,875	671,779	723,088	200	200	960 0 0	60 0 0	0 6 0	0 6 0
Total ...	...	...	...	...	679,949	730,572	252	251	...	...	...	...
MADRAS.												
Nilgiris	220,070	233,769	...	2,000	220,070	235,769	145	156	*	*	*	*
BRITISH BURMAH.												
Akyab	25,000	18,000	...	...	25,000	18,000	209	150	9 6 0	9 6 0	0 14 0	0 14 0
Total British India ...	...	...	...	...	26,526,317	29,557,482	...	...	...	...	...	...

* No information available.

† For 165 plantations in 1875-76 and 146 in 1876-77 the figures are merely estimates, no returns having been received from the managers. The figures in column 12 are not trustworthy owing to want of complete figures for the area of land under mature plants.

‡ The figures for this district are for the calendar years 1875 and 1876.

§ Not including some plantations existing in 1876-77 for which no returns have been received.

‖ The figures for 1876-77 are exclusive of 6 plantations in the Kumaon District and three in the Garhwal District.

NOTE.—The figures in column 12 do not in all cases correspond with those obtained by dividing column 5 into column 11, owing to errors in the local returns from which this table has been compiled.

LEAF-DESTROYING CATERPILLERS.

WITH reference to the remarks in our January issue, on the tea-leaf destroying caterpillars, the following will be of interest :—

To

The Secretary Board of Revenue.

SIR,—With reference to the Board's Proceedings No. 2956 of 4th November 1878, I have the honor to report that the caterpillars from Coonoor sent to me are the larva of some moth belonging to the Tortricida or leaf-rollers.

2. Some of the species are very destructive to the vine, oak, roses, and other plants, and the one now existing near Coonoor might become a very serious pest on tea estates, were it to increase to any considerable extent.

3. I regret to be unable to offer any suggestion with a view to the destruction of the caterpillars. Their natural enemies, the birds, will no doubt destroy many of them, and climatic influences may also help to reduce their numbers.

I have, &c.

(Signed) G. BIDIE, *M. B., Surgeon Major,*
Supdt. Govt. Central Museum.

Govt. Central Museum,
Madras, 12th November 1878.

LAHARDUGGA.

(FROM OUR CORRESPONDENT.)

Palamow, New-year's Day.

THE whole of the jungle and young sâl trees have been frost-nipped and are shedding their leaves, as also plantains and ornamental shrubs around the bungalow. Fortunately, tea bushes are not so delicate and have stood out the frost fresh and green, save a few of the delicate pure Assam *jât.* Of these the oldest leaves suffer from the frost, but, strange to say, the tender shoots, left from the last plucking, remain intact. To guard against sudden changes of weather—for heavy hail falls here—tea seedlings should all be covered with a cone of thatch. This is not expensive, and makes certain of the plant being protected from accidents of any kind till spring arrives, when of course it must be removed. It seems strange that those persons who have ventured into tea operations, should confine themselves chiefly to the vicinity of Ranchi. The lease-holds about there are not pucka, and present land-holders may probably find to their cost that when the gardens become valuable, and yield a large outturn, the rightful owners will turnup to claim the whole. In this sub-division there are thousands of acres of Government waste lands which can be leased from the Crown, and Chota Nagpore is the fountain-head from which pours the stream of the best tea garden coolies.

The whole country is covered with sâl forests. Why Government should reserve extensive tracts of them, decimate whole villages and turn the "reserve" into a wilderness, is puzzling indeed to the uninitiated, sâl logs cannot be floated down the mountain streams, owing to boulders and cascades and to carry them out of the "reserves" by cooly labor would not pay. The villagers, being ousted out of their old homes, emigrate to the tea districts; and from these they seldom return, owing to the high rate of wages. Should they return, it is merely a run "home" to spend their surplus cash, to astonish their relatives, and induce them also to emigrate to the Eldorado. There are, however, thousands left who benefit by farming the absentees' land, and tea planters need never trouble their minds up here on the score of labor. The pay is from two to eight pice according to age, and to the work done per diem. No risks are run by large advances or epidemics. Once the confidence of these semi-wild people is secured, you can do anything with them as regards factory work; they are as impulsive and confiding as children, and become attached to the employer and garden.

MOSQUITO BLIGHT.

THESE insect pests, it is known, are increasing in their destructive efforts on the tea plants of Assam and Cachar. It has been argued that their presence is the result of exhausted soil; and where young estates, opened out on rich virgin soil, have suffered, a cause has been sought for in the seed from which the plant was raised: impoverishment of the soil is the argument, and doubtless the conscientious belief of many able men, whilst others seek immunity by a more careful selection of seed. A remedy is also sought in extra cultivation and in using manure; still the pest is present, and we know many promising estates where, though soil, seed, and position have been all that could be desired, and labour superabundant, yet nevertheless the Garden has been almost black, and the crop of the season ruined by this dreaded mosquito,—devouring wood as well as leaves, and sucking out the very core of the young stem.

We were much interested some time ago to learn that the "Asiatic Society" had this matter under consideration, and that a practical entomologist would probably be brought out from home to make a lengthened tour throughout the tea districts with a view to study the subject of these insect-blights, so as to better understand them and admit of a remedy being adopted. We know this measure has the approval, and would receive the support, of several proprietors, but we apprehend it is not acceptable to all. We presume it would be difficult even for the "Asiatic Society" to trace and find a remedy for this growing serious evil, in a way that would be approved of by every planter; and hence the evil is perpetuated. It were better perhaps, then, for a few earnest men to carry out such an undertaking, even though many hold back, than to left it fall through. A very few maunds of tea would represent Rs. 1,000, and Rs. 15,000 is we believe all that will be required to support such an enquiry, and carry it through for two succeeding years,—time sufficient to exhaust the subject thoroughly, and probably lead to a comprehensive system which would return, even to a dozen contributors, if they each had 500 acres of good Garden, the cost of such an enquiry by the gain of the first season.

The planters as a class hold varied views regarding these pests. Some hold that the mosquito cannot be destroyed until the surrounding country is thoroughly drained; and consequently they see no remedy; others dread the proximity to forest lands; whilst others argue that mosquitos migrate, and are capable of flying in a brief period a distance in search of food. But those all, earnest men, appear to lose sight of the fact that the mosquito is a pest that was unknown until within the past few years, and that it is now becoming more destructive every season.

We believe, however, that the evil may be remedied, and we trust, for the sake of this large industry, that the few who can influence the many will unite in organising and carrying out this scientific and practical enquiry; and, if possible, endeavour to stamp out this growing serious evil.

A correspondent sends us the following memo, on the subject of Blight, the result, he says, of considerable experience by a practical man, on a badly blighted garden:—

Split dry bamboos, make into convenient size bundles, set fire to same and apply in the following manner:—One coolie at either side of the bush to hold the lighted bamboos or torch underneath, and shake about so as to disturb the insect, but at the same time not to injure the leaves or bushes; another coolie to hold a torch over the bush, which will be found to singe the insect in its endeavour to escape; every blighted leaf to be carefully plucked immediately after, and what is not fit for manufacture, to be burned or otherwise destroyed; and should this course not prove quite effective the first time, the blighted bushes might be gone over again in a similar manner.

Having requested one of our managers on a blight-affected garden in Cachar to carry out this plan to the letter, we have the following from him, dated Cachar, 5th November 1878:—

"I had the piece of tea affected carefully gone over with blazing bamboos, and the following day I had every leaf that was in the least marked by blight carefully plucked as directed. I found that for nearly six weeks there was little or no appearance of blight, but after that it made its appearance again and is now nearly as bad as ever. I feel certain that if the plan were carefully carried out, and commenced when blight makes its appearance on small patches of tea, that a great deal could be done in the way of checking blight."

What we understand by this is, that the experiment was so far successful but that the re-appearance of the blight was due to its presence on patches not operated on in the manner described; and that, to render the cure in every way effectual, it must be begun before any advanced stage of disease is reached. This is true, no doubt, and it is far better to essay a remedy in time than to wait till the blight has got too firm hold of a garden, when it is difficult if not impossible to eradicate it. It would be far better to sacrifice a patch of cultivation at an early stage of the appearance of blight than to permit it to spread, as, for want of precautions taken in time, is too often the case.

Blight seldom attacks at one and the same time, or at all equally, the whole of a garden, and there is good reason to believe that, were vigilant care used in discovering the earliest indication of blight, and prompt and decisive measures adopted for stamping it out when it first appeared, the extension of the evil might be considerably diminished."

COFFEE.

WE hear that the Chief Commissioner of Mysore has granted the petition of the Munzerabad Planters' Association to permit Mr. Harman, the Superintendent of the Bangalore Experimental Farm, to visit their estates to investigate leaf-disease.

A CORRESPONDENT writing from Peermed, Travancore, in December says:—

"Crops of coffee up here are turning out as much and more than estimates; very little light floating coffee, in comparison with the last two years. New clearings for coffee are being felled in spite of the leaf-disease appearing year after year. Some tea has been planted in forest soil and promises better than on grass lands, although the value originally of the forest was Rs. 1 per acre against Rs. 2 now for grass land. The land, 30,000 to 60,000 acres that has been taken up by Messrs. Munro & Co. in north Travancore on the Cardamon Hills is being opened in coffee, tea, and cinchona; it belonged to a petty Rajah who paid a subsidy to the Maharaja of Travancore."

The manufacture of chicory and fig coffee in Austria has made great progress, and now reaches about 250,000 metrical quintals annually. Bohemia stands at the head, where large establishments carry on the manufacture; Styria, Meravia, Vienna and its environs Carniola and the Tyrol may also be mentioned.

We believe that a planter in Ceylon has offered to settle down in Burmah with the object of cultivating coffee and cinchona, if the Government will offer liberal inducements.

The coffee leaf disease has broken out badly on the plantations in five districts on the west coast of Sumatra, and in four other districts a different disease said to be caused by insects, and which attacks the roots of the plants, is doing much damage. In parts of Java the sugarcane has been attacked by swarms of rats, in such numbers that parties of natives offered rewards for killing them, bringing in from 600 to 1,000 tails daily.

AGRICULTURE FOR COFFEE PLANTERS.

By A. C. Dixon, F.C.S., M. R. A.S.E., B. Sc. & Sci. M.B., (London.)

All matter is organized or unorganized. The latter constitutes the mineral kindom ; the former is subdivided into the vegetable and animal kingdoms. The vegetable is formed of the elements of the mineral re-arranged into forms of greater complexity. The animal organ re-arranges the vegetable into still more complex forms ; but both at death resolve back into the simpler compounds from which they were derived.

Now man is altogether dependent on the vegetable, either directly or indirectly, hence it is of vast importance to him, so to work the soil to produce vegetable matter, suited either for his own sustenance or for that of animals with which he works, or upon which he may feed. Nature has clothed the earth with vegetation which may yield sufficient food for a time without trouble to a small population, but with increase of population we must have increase of food material, and so it has become necessary to cultivate systematically the most suitable forms of vegetation. This constitutes agriculture—it may be for the production of plants chiefly for seed, or for roots, tubers, bark, fibre, leaves, herbage, or forage. In Ceylon we have instances of all these. The seed crops, however, predominate.

It is not sufficient to find that a certain area of the earth's surface yields a certain crop in abundance without much trouble, and removes its produce from year to year, without returning any equivalent to the soil. If such a course be pursued, we may soon expect to exhaust its power. In order to maintain it, we must return certain incombustible elements to the soil, and in order to fully understand the life, history, and the manipulation required in the raising of various crops successfully, we must consider the bearings of several branches of natural science. For example, geology to give us an insight into the characters and capabilities of the soils in different areas; chemistry, to tell us about the compositions of the soil, plants, and manures with which we feed it ; botany and vegetable physiology for understanding the laws of growth and development of plants ; heat, light, and electricity—how they influence plant life ; meteorology, to give us an idea of climate; animal physiology for the proper treatment of animals employed ; and, lastly, mechanics, to guide us in the use of tools, machinery, &c., connected with various crops. From this we see that agriculture, is not, as many suppose, a mere mechanical art, but a comprehensive science, embracing the principles of many departments of knowledge, all of which have rendered important services.

The causes which have operated to retard its progress are numerous. Those referring particularly to this island, we shall not dwell upon at present. The soil with which we work is somewhat complex. Chemistry has resolved all matter, whether solid, liquid, or gaseous, into an alphabet consisting of about sixty-five elements. Now, out of these we have to deal mostly with the following :—Oxygen, hydrogen, nitrogen, carbon, phosphorus sulphur, chlorine, silicon, potassium, sodium, calcium, magnesium, aluminium, and iron. These occur in the soil in various combined forms, of which we shall have to say more hereafter.

Plants are generally regarded as ternary compounds, consisting mainly of carbon, hydrogen, and oxygen. Nitrogen, however, is one of their essential elements and several others occur in small quantities. Animals are mainly quaternary, consisting of carbon, hydrogen, oxygen, and nitrogen. That which remains after burning a plant is the inorganic or incombustible constituent ; the other portion passing off, the combustible or organic.

Seeds which contain the germ of the young plant, when surrounded by suitable conditions, *viz.* moisture, a certain amount of heat, and air, germinate or begin to grow, sending forth tap roots as in coffee, or adventitious roots, as in paddy, into the earth, and a stem into the air. It continues to grow until it reaches maturity, or until its parts are no longer able to perform their functions. Its period of life may be less than a year, as paddy, or it may be long lived, as coffee. The food of the plant must be in a liquid or gaseous form. The liquid is taken up by the root hairs. This is accomplished by the joint action of several forces, such as *capillarity*, where the liquid food ascends tubes constituted of narrow cells, by the same force that ink travels along blotting paper. This is assisted by a pulling force due to the evaporation of the watery part of liquid food from the surface of the plant, so inducing more to ascend ; and this is still further aided by the force of *osmosis* or interchange of liquids of different specific gravities, when separated by any organized membrane. When such is the case, there is always a tendency to establish an equilibrium of density, and to produce this, the external liquid must receive a portion of that within, and so we have a double current, the one inward, called *endosmose*, the outward *exosmose*. The liquid taken up by the root hair is of less specific gravity than that already in the cells, which has been thickened by loss of water due to evaporation. By the combined action of these forces the crude food is carried up to the leaves, there to be elaborated by the action of light and heat, and so made fit for its growth and nourishment. As long as these root hairs find sufficient food, and there is freedom of circulation, the plant will continue to thrive, hence we see the importance of having the soil in such a condition as to allow these root hairs to traverse it easily.

As every cultivator should be able to act the part of doctor to his various crops, he ought to have some general knowledge of the structure and functions of the principal parts or organs. Just as words are composed of syllables, and syllables of letters, so plants of tissues, and tissues of *cells*. A cell, therefore, is regarded as the most elementary part of its structure.

The stem consist of various tissues, each having a certain duty to perform. They are built according to two great plans, the one with its woody tissues in rings, as in the coffee, the other irregular, as in the cocoanut palm. Let us take for illustration the coffee stem. We have a soft tissue at the centre called pith, surrounded by a woody tissue, which increases from year to year in ring-like fashion. This tissue is succeeded by the cambium or formative layer, and that by bast. From the cambium region, wood is added internally, and layers of bast, (a very useful product in many plants, *e. g.*, for making gunny bags) are added externally. This bast is surrounded by the epidermis or outer bark. The duty of some of these tissues is to transmit, that of others to secrete.

Next we come to the leaf. This is a flattened expansion of the stem, having corresponding parts. Its purpose is to expose to the greatest possible extent the amount of crude food taken up by the root, and conveyed by the stem to be exposed to the action of light and heat, there to be assimilated. Leaves are provided with stomata, or little pores, through which they can take in or give out gaseous matters. They take in carbonic acid gas, given off by animals when they live, and they give out oxygen to carry on the life of the animal. We have thus seen that a plant may be said to absorb, breathe, assimilate perspire, and excrete.

Flowers, which appear at some period of life in the higher plants, and when ripe become fruit, are for the purposes of reproduction. In many cases we often reproduce from a cutting placed in the ground, or upon another stock.

A complete flower consists of four series of organs. The outermost is the calyx or cup ; the next the corolla. These organs serve to protect the more delicate organs within as well as to attract insects which aid fertilization. We next come to the stamens, or male element of the plants and then the pistil or female portion. After fertilisation is effected by the pollen from the stamens, that part of the pistil called the ovary, containing the seed or seeds, increases according to the nourishment supplied. It ripens and becomes fruit. These last organs, when the flower is in bloom, are easily injured by wind and rain, and so affect the crop of fruit to a great extent. These injurious influences may be absent, and yet, although flowers were abundant, the fruit may be small, owing to the tendency of a plant to make wood or leaf, from which its attention may be diverted in some cases, by pruning the stems, or in others the root.

Now let us consider more in detail the soil, or decomposed outer portion of crust of the earth, as well as the great mass of liquid water upon its surface, and the air by which enveloped. First as to its origin : this takes us far back into the history of the earth. How formed in the first instance, we will not venture to say at present. The great changes of the three great masses of matter, the storms of

land as earthquakes, the storms of water and those of the atmosphere, have played a very important part in making it what it now is. Just as the animal, vegetable, and mineral are necessary to keep up equilibrium of action, so two great antagonistic forces in the earth,—the levelling and elevating—keep it in equilibrium. As one country subsides, another is up-heaved slowly; as one tract of land sinks down, and may be entirely lost, as islands at the present day in the Pacific ocean, so another is up-heaved, or it may be a new island appears out of the water. Constant change is going on. The aqueous and atmospheric agencies tend to plane all down to a level, the volcanic agency, or that resident within the earth, to produce unevenness. The rocks here have been thrust up by volcanic agency. No doubt, Ceylon was once united to the main land of India, that the land subsided and left this an island, and that we are now slowly rising again. We have plenty of evidence in proof of this. These vast masses have been carried out by the action of water in the form of rivers, carving their way through the softer portions from the higher grounds to the lower.

The hard or soft portions of the earth, whether exposed to the air or deeper seated, are either of volcanic or stratified origin, which last may have been greatly affected by heat, and so become metamorphosed or changed, sometimes so much as to be confused with strictly volcanic. The stratified are so called, because they have been deposited in strata or layers by water, in a somewhat uniform manner, just as strata are now being deposited in lakes and oceans of the present day. In many countries, these different strata, which once formed the beds of ancient seas and oceans, and of which we have but little knowledge, save by fossil forms of plants and animals that found a resting place there, may easily be made out, sometimes occupying a flat area, in others, out-cropping and forming ridges or hills. It is somewhat difficult to make out the stratification here, though it can be seen in a few places.

The hard rocks so abundant in the hill country or underlying the the cabooks in the low districts, are known to geologists by the terms granite and gneiss, with other names denoting rocks near akin to these.

The three elements of granite are quartz, felspar, mica, of gneiss the same, but in the latter case the minerals are more in layers than arranged promiscuously. Passing through the country, we see these vast masses, some standing out more prominent than others, namely, those which have had the greatest power of withstanding disintegration. On looking at many of these, we may notice how the rain is gutting them on a minor scale, just as the whole mass has been gutted by our great rivers. These disintegrated rocks on the slopes of the hills form the soil of the planter, while those of the flatter regions form soil adapted to various other forms of vegetation. All have a use and can be turned to practical account. In some cases, we have the surface soil composed not of the decomposed rock upon which it rests, but of matter transported from other localities, from which it has been washed, such as great alluvial tracts.

As vegetation has flourished upon the surface, so the rocks, whether hard or soft, have become decomposed, in some cases to a considerable depth. This action continued through long ages, and aided by decaying vegetation, has formed what we call a virgin soil,—soil which has had all its own way up to the time the cultivator takes possession, then to be directed anew into a fresh line of action.

The soil therefore in the main depends on the rocks from which it is derived. Yet the soil here must not be pronounced bad or non-fertile: many of the soils are good and capable of very great development: they require proper handling. The English soils were not brought to the state they now are in a brief period. The rivers to which I referred are gradually scarping out the land at a slow rate, and transporting thousands of tons of good soil per year, as well as large quantities of good plant food, more especially from the slopes of the hills, where the water falling acts as a scoop to convey the virgin soil, or the rich carbonates produced after a burn—hence the wisdom of breaking the force of the running waters and their contents by terracing and giving it a good chance to be absorbed by deep cultivation, just as we have a pulling force acting on the leaves inducing the crude food to ascend so we have on the face of these terraces a pulling force, the sun tending to pull the moisture through, and the air after it, thus inducing a free circulation.

According to the steady action of the internal heat of the earth, and pressure to which the strata have been subjected in long periods of time, we get strata of different densities. Here we have a dense one of gneiss or granite and other kindred rocks which by disintegration have yielded a soil having properties dependent on its component minerals, modified by decayed vegetable matter, called *humus*. The color of the soil depends partly on this humus as well as on various oxides of metals, notably iron, which gives reddish hues similar to rust. So we, have black, chocolate, reddish, and yellowish red soils. The color too affects the power of absorption of heat a dark soil possessing that property in a high degree for the same reason the floor of the barbacue is made black in preference to any other, in order to absorb the heat readily.

As to the chemical composition of the soil, *quartz* is a chemical compound not a mere mechanical mixture of the elements, silicon and oxygen. It may be white as found on some estates, or of a yellowish tinge as sea sand, or other colour as jasper, agate. This is a very insoluble substance, and is a great agent in keeping the soil open. *Felspar*, a mineral of various colours, is chiefly of two varieties—potash and soda. The common form here is, potash felspar. It is chiefly composed of silicic acid, potash and alumina. The alumina is the great retentive agent for moisture: mica is a glistening mineral, scaly or in plates composed of silicic acid, alumina, potash and iron, smaller quantities of other minerals such as hornblende, epidote, &c., occur here and there.

Dolomite, a double carbonate, that is, a carbonate of calcium, (the base of lime) and magnesia, is also found in large masses in some parts of the Island in a highly crystalline form.

Cabook met with abundantly in the low country, is of the same composition as gneiss, from which it has been derived by decomposition. A lime formation, a sort of breccia,—occurs in the Northern Province.

Since the crops here are of a permanent character, not so much attention has been given to the preparation of the soil previous to its being expected to do duty for a number of years. In some cases, the idea is to get the portion cleared and plant into the ground at once, forgetting that it cannot be meddled with, to any great extent, in after time. It is necessary that there should be a free internal circulation in the shape of drains, and the soil in a good physical condition, and that to a good depth.

Now with respect to the physical state of a soil. It is composed of particles of various degrees of fineness, some as fine as flour, others pebbles, and in some cases large boulders of undecomposed rock. Now the finer the state of division,—provided it be not too much so as to form a sort of paste when moist—the more work it is capable of doing. The deeper we go from the soil to the subsoil, the more compact we find it. The more open it is, the greater the surface exposed to the action of air and water and the greater the absorbing power for gases brought down by the air. We get a similar idea of this great absorbing power of gases from charcoal, when we use it, say for absorbing the gases resulting from the decay of meat, or for absorbing the coloring matters from sugar.

The soil must be somewhat of the nature of blotting-paper, and the ingredients—potash, phosphoric acid, and others—must occur in the soil in two different forms of combination; the one chemical, the other physical; the former being ready to be acted on, and brought into solution to take up the latter state, and so distributed, physically, through the soil: in this form only can it be made use of by the plant. Hence the difference between cultivated and uncultivated land; and just in proportion as these matters occur in a physical state, so will the soil be able to nourish the plants placed upon it. In order to bring the other portion into use, we must have the presence of moisture, a certain amount of heat, and plenty of air!

Tillage, or breaking up the soil, multiplies the surface exposed to the action of air; and this requires to be done to prevent a maximum of such surface, just as the stem is spread out into leaves, to be exposed to the action of air, light, and heat.

The question as to how much of the nutritive substances a soil must have to yield good crops, is a very important one; but difficult to answer. The nutritive power depends on the quantity of such in physical combination; and if chemical analysis cannot distinguish the chemically combined, we need not expect a satisfactory answer. For a long time, cultivators and chemists thought that by analyzing a soil, all the difficulties would be solved; but experience has shown, and is still shewing, that in may cases it does not assist in improving the soil, nor yet tell why certain crops fail, such for instance, as the recent, analysis of soil on the Kaluphana estate. We have apparently similar soils as Kahagalla, producing good results. This plainly shows that the analysis of soil, as usually performed by chemists, does not always afford a sufficient guide to the capability of the soil; nor yet to tell us the kind of manure particularly well adapted for crops required.

The detailed analysis of a soil, gives only the proportions of its different constituents, and these, without any reference to the state in which they are combined.

Such analyses are often disappointing in their practical bearings; hence the need, not of a chemist, pure and simple, but of an agricultural chemist; and by this I mean not one who can only estimate the elements in a soil, measure, or produce, but at the same time who has studied the effect of different manures on different soils, and their different modes of action, just as a doctor knows that what will do for one person, will not be suitable for all—there are constitutional differences in soils, as well as in human beings.

Yet chemical analysis has done much, and furnished reliable information on several points. It tells us what kinds of artificial manures are best suited for soils differing in composition: whether special manures or lime may be applied with advantage: whether we may burn clay, and use it with profit, whether non-compounds produce humus whether some valuable ingredients are in the soil in excess, which might be beneficial in a more diluted form; and lastly, whether any given element is not in sufficient abundance,—*Ceylon Times.*

ANTIDOTES TO LEAF DISEASE.

Udapusellawa, November 9th, 1878.

SIR,—I noticed, in a late issue of your paper, your allusions to my experiments with sulphur, as a cure or antidote for leaf disease. I should have pre ferred to remain mute on the subject for some time longer, until I could speak with absolute certainty on the subject.

What made me first think of sulphur, was seeing the French peasantry industriously dusting with it every leaf of the vineyards in the neighbourhood of Mentone as a cure for oïdium. That disease is marvellously like that which we are endeavouring successfully to combat: indeed, I fancy that it requires the microscope to detect the difference; to my unaided eyes they seemed identically the same. On my return from wintering in France to England, I sought for information regarding the progress of coffee cultivation in other countries, and asked particularly if leaf disease had been noticed. In Trinidad, Mexico and Guatemala a very superior coffee is grown: indeed the finest sample of coffee, as regards length, compactness, and regularity of size of bean, which I have ever seen, was grown on the sierras of Mexico. I am satisfied from all that I have read,

and from all that I could learn from residents in some of those countries, that Central America is, as yet, *free* from the disease.

Early this year, I met a Dutch gentleman, who is part proprietor of a large coffee estate in Java. He had been on a tour through the coffee districts. His remarks shewed him to be a gentleman of great intelligence and a close observer. He was positive that no leaf disease had been seen in Java, and also mentioned that the finest estates in that island were in the neighbourhood of extinct volcanoes. This helped to confirm the idea that had been for some time in my mind, that volcanic countries are free from leaf disease, because their soil is impregnated with sulphur. If it is a fact that the pest has appeared in Brazil, it would only confirm the likelihood of my theory, for I believe that empire is geologically similar to Ceylon, with a primitive formation of granite and gneiss. In April last we had a slight attack of leaf disease on this estate. I had only a limited supply of sulphur at the time, but applied what I had, liberally and freely dusting the trees and mixing a handful with the soil round the roots. The disease completely disappeared within a month, but unfortunately for my theory, it also, a little later on, left the coffee on which there had been no application. The effect, however, on the disease was very marked. I am now prepared with a good supply of sulphur and am watching for the first incipient signs on the leaf, which presage an attack, to try again. I am satisfied that if the application will not prevent the disease, it is at any rate a palliative that hastens its departure. Lately, one nursery, about five acres, was attacked and in a short time was as yellow as gold, so bad that I thought a portion of it would be snuffed out altogether. I applied the sulphur when my stock arrived, and now it is as green, and healthy a lot of plants as one would wish to see. The difficulty was, in this case, brushing the sulphur in amongst the leaves, the plants being so closely packed together.

I consider it proved, beyond a doubt, that in small areas as a nursery the disease can be banished, with ordinary care in applying sulphur, in time.

Whether it can be driven out of an estate is as yet "*not proven*."

On our nine hundred acres of coffee we have not at present a diseased leaf, but if the enemy appears I am prepared to fight him. Until I have had more experience in this matter, it would be foolish to speak positively, or confidently; but if I gain the victory I will not fail to let my brother planters know.

Another point, which others as well as myself should try to determine, is whether sulphur is an antidote to the disease; whether a timely application, enabling it to permeate the system of the tree, will give immunity from all attack. The field that suffered here last year was bearing 10 cwts per acre, and ripened it, nearly all, although it lost a deal of leaf.

I presume that the germs of the disease are there amongst the fallen leaves. I intend giving this field a dose in February or March just before the time when I expect the disease to appear, if it appears at all.

I am as yet an enquirer and do not arrogate being the discoverer of a positive cure. I am groping in the dark, looking for light, but I think so far, there is no reason to be discouraged.

Since Messrs. Matheson & Co. began to work the Rio Tinto mines in Spain, they have discovered literally a mountain of sulphur. They use it for smelting the copper pyrites, yet have sufficient to supply wants of the world.

Flower of sulphur costs about Rs. 5 a cwt, in London, but in a crude form could be shipped, at the port of Ferrol, for probably less than half that price, should an extensive demand for it spring up in Ceylon.

This Government should follow the example of the French, by passing it free over the Ceylon Railway and declaring it free of all import duty. —*Ceylon Observer*.

G. A. DICK.

THE *Ceylon Observer* has received from the Secretary to the Planters' Association, the letters we reproduce below :—

DEAR SIR,—As I understand that it is not improbable that some attempt may be made to arrest the ravages of *Hemelia vastatrix*, I shall feel obliged if you will lay the following suggestions on the subject before the Committee of the Planters' Association. At the same time as I offer these suggestions, I wish it to be distinctly understood that they are only suggestions, and as such must commend themselves to the common sense of planters generally before they can be adopted. Should any or all of them be adopted, it must be on the responsibility of planters themselves, and no responsibility must attach to me if after considerable outlay the results should, not be what were hoped for. In what follows the *general* habit of the fungus only is treated of.

The disease, it is believed, is conveyed into the leaf during wet weather, when the stomates are more open than usual. After remaining there for some weeks, dry hot weather causes it to produce fruit on the outside. This fruit forms the orange-coloured blotches by which the disease is readily recognized. In districts with well-marked wet and dry seasons generally, the chief outburst of this form of the pest is shortly after the rains have ceased. In the Pussellawa district, where the rains mostly cease about the end of the year, it is generally I believe, about the end of January or early in February. There will also probably be similar but less pronounced outbursts when the dry interval between the S. W. and N. E. monsoons is very decided. This being the case, the best time to attempt to arrest the spread of the disease is, whilst the dry weather fruit is coming to maturity; for it is evidently impossible to save the leaves that have once become infected and the only reasonable plan is to destroy them as soon as possible I have reason to believe that the sporanges (orange dust) require to be sometime exposed in a dry state before they become capable of germination and that they do not germinate readily when quite fresh from the tree and retaining their bright orange tint.

To destroy these sporanges ought to be the chief object, before they become scattered; as they will be, when ripe, under the influence of the wind. I would therefore suggest that:

(1) All diseased leaves that may fall from the trees be at once carefully gathered in bags and burnt—the bags should be made of some close material to prevent the escape of the sporanges, and be disinfected frequently.

(2.) Where proprietors can afford it, the diseased leaves should be carefully picked from the trees and burnt, soon after the attack has fairly manifested itself.

(3) All prunings, whatever the time of year, should be carefully burnt at once.

(4.) The stems and larger branches of the trees, ought to be well washed in the middle of the dry season with a suitable solution for destroying the parts of the fungus that may be clinging to the bark. Kerosine, carbolic acid, Condy's fluid mixed with water or a solution of lime or sulphur, would, I believe, answer the purpose.

(5.) All the ground in the neighbourhood of the trees, roadways as well, should be sprinkled with quicklime, in the middle of the dry season.

(6.) A second sprinkling of lime a week or two before the end of the dry season or between the two monsoons would increase the chance of killing the sporanges.

(7.) All decrepit trees that do not pay for cultivation and only serve as a breeding ground for the pest, should be cut to the ground.

(8.) An isolated valley like Maskeliya or Pundalueya is favorably situated for trying these experiments, which can scarcely be tested fairly in less than two years.

(9.) Keep on manuring as usual.

(10.) Notice carefully the patches on an estate where the disease is worst, and find out the reason for this in regard to situation, &c., so far as possible. Notice if the disease is worse near any particular trees or plants, decaying timber or vegetation of any kind.

(Signed) R. ABBAY,

Little Bromley, Manningtree, Nov. 5th, 1878.

To the Secretary of the Ceylon Planters' Association.

Little Bromley, November 21st, 1878,

DEAR SIR,—In my letter to you of November 5th in reference to the treatment of coffee estates and coffee trees in order to get rid of or mitigate the ravages of *Hemelia vastatrix*, I suggested the use of kerosine as a wash for the trees. It has occurred to me since then that the inflammable nature of this liquid would render it dangerous if used, especially in the dry season. No doubt the same objection has already occurred to practical men. I would therefore substitute for kerosine the words "urine from cattle establishments, especially when fresh." Will you also add to my suggestion about picking diseased leaves from the trees the words "where specially practicable."

I remain, &c.,

(Signed) R. ABBAY.

To the Secretary of the Planters' Association.

Apart from burning with fire and quicklime, it will be seen that Mr. Abbay recommends certain washes. Amongst these was kerosene, but he recollected its inflammability and advised the substitution of a substance which is in reality, apart from its possible effect on fungi, the best possible form of liquid manure. The truth is, however, that kerosene has been already widely used by planters as a wash for the stems of trees, with reference to the attacks on the roots by white grubs, mealy bug, and fungi not allied to leaf disease, which Mr. Abbay has told us is *sui generis*. But, of course, the kerosene was used in a highly diluted form, as we suppose it would be by any person applying it for leaf disease.

NEW METHOD OF HOLING STEEP LAND.

A CORRESPONDENT of a Ceylon contemporay writes concerning an experiment as carried out on about three acres of a steep new clearing on the Uva side of Nuwara Eliya. It was planted up during the last south-west monsoon with coffee and cinchona.

A man and a boy take a line between them. The former with his mamoty knocks the peg well into the earth and then proceeds to cut away the soil all round. When finished the cutting consists of the following dimensions, *viz.*, about 18 inches on the upper and $2\frac{1}{2}$ feet on the lower side and 2 feet in width; the depth will of course depend on the slope of the hill. The steeper it is the deeper the cutting.

The boy with a small alavange or pickaxe (without the handle) now sinks a hole in the centre 15 inches deep and 6 wide ; this is filled up with surface soil and is then ready for the reception of the plant. Between them the two coolies cut a hundred holes. The cost therefore is much the same as ordinary holing. Now for a comparison between the two methods.

At present, holes are cut for the express purpose of forcing on plants, after which to say the least they are useless. Indeed there is reason to believe that in some soils more harm than good is done by holing. For instance in clay lands after the young roots have penetrated the soft soil and come into contact with the outside of the hole, they receive a sudden check which must prove hurtful to a tree just at the time it wants most nourishment, for it would then likely be about 18 months old.

In the new methods we have firstly a deep narrow hole surrounded with a cleared space which hereafter can easily be loosened up as the plant grows "thereby gradually introducing the roots into the soil."

Secondly, the soil is opened up to the beneficial action of the sun.

And, thirdly, the ledges or terraces, while the clearing is new, will be the means of accumulating a part of the surface wash ; and eventually the constantly falling leaves. They will furthermore do duty as manure holes. But enough has been said to show that whilst in one case an expensive work is undertaken for a single and doubtful object, in the other we have for a similar outlay, work which will not only be beneficial at first, but will remain a lasting benefit so long as the estate exists.

So much attention has been directed recently to the future of coffee culture in Coorg, that Mr. Lewis Rice, the Director of Public Instruction, Mysore and Coorg, has devoted several pages in his *Gazetteer* of Coorg, recently published, to the subject. Mr. Rice has had ample opportunity of enquiring into the present state and future prospects of coffee-culture in Coorg and therefore we must give some weight to his opinions. We cannot help thinking, however, that some of Mr. Rice's arguments are inconsistent. In one place he remarks :—" Coffee may yet succeed in Coorg, and the undaunted planter may yet have his reward if the method of cultivation best suited for each locality is carefully adopted, and if, with the increase of jungle vegetation, especially bamboos, better seasons may be expected to return and the white borer to disappear." The impression left on the mind of the reader—and it is the correct one,—is that the white borer still pursues his ravages and is yet dreaded, but further on Mr. Rice contradicts himself, for we read :—" The borer is, however, no longer the dreaded enemy to the insidious ravages of which the planter has helplessly to resign himself. Its destructive progress has not only greatly subsided, but experience has taught the planter by vigorous and timely measures, to keep it down to a minimum." Setting aside Mr. Rice's inconsistency, there is no use disguising the fact that the borer exists in Coorg, and is as much to be dreaded as ever. We agree with the writer, however, in urging the planters not to give way to despair. The use of artificial manures and increase of shade will probably keep off the dreaded foe. As to seasons, the new instructions issued by Government for conserving the forests in Coorg will, doubtless, in the course of a few years, increase the rainfall in the district. From the figures furnished by Mr. Rice, it is evident that the export of coffee from Coorg has been falling off considerably of late years. In 1872-73 the export was 6,497 tons ; in 1873-74 it fell to 4,887 tons ; and in 1874-75, to 4,234 tons. The total number of estates in Coorg is 4,235, covering an area of 106,759 acres, and yielding an assessment of Rs. 96,241. About 50,000 acres of the whole area are held by Europeans. It seems probable that coffee culture was introduced into Coorg about the same time as into Mysore. Mr. Fowler was the first European planter in Coorg ; he opened out an estate in Mercara in 1854. Mr. H. Mann, Dr. Maxwell, and others, soon followed, and the climate of Coorg being such a genial, healthy one, coffee-culture in that Province attracted numbers of Europeans. To the great rush which was made to Coorg, may be traced, we are of opinion the commencement of bad seasons, and the advent of the borer. Several of the immigrants were Ceylon planters, who had not learnt to value shade. The evil example spread ; the jungle was ruthlessly felled, and, in consequence, the rain-fall soon decreased, and the borer, driven from his native habitat, to the bamboo, took to the coffee tree. It is only time and patience which can remedy these evils.

THE PERAK COUNTRY.

THE last mail from Singapore brought advices from Mr. Forres Lawrie, regarding the Perak country, and its supposed suitability as a field for European enterprise. The letter received from this gentleman enclosed a sample of coffee taken from a Malay garden 1,800 feet above sea-level. The bean is well-formed, though not large, and of a rather dark and dull color, somewhat resembling Natal coffee. The writer of the letter in question does not appear to have formed such a favourable opinion of the country as Messrs. Christie and Handyside entertain, and he says, that although there are navigable rivers which enable a traveller to obtain access to the high lands suitable for cultivation, the tedious boat journey of three days and three nights, was in his opinion, a great drawback, as in the event of floods there might be a risk of being cut off from communication with the coast settlements, and thus incur risk of having a large labor force starved out. For this and other reasons, Mr. Lawrie would be induced to give the preference to the low country where there is an abundance of good soil suitable for tropical produce of all kinds, and where the climate is favourable for health. As regards this part of the country, the writer, says, he will be prepared to furnish a full detailed report of the localities he has visited touching soil, climate, capacity, cost of production, &c., &c., if he can find twelve persons sufficiently interested in the matter to subscribe Rs. 100 each for the results of his experience and opinions.

THE COIMBATORE COFFEE WORKS.

ONE of the largest Coffee Curing Establishments in Southern India is at Coimbatore. The Firm of Messrs. Stanes and Co. commenced business in 1861, and has had a most prosperous career since. At the present time it cures and ships 1,500 tons of coffee annually, and numbers among its constituents almost the entire body of Neilgherry planters, European and Native. With the growth of the business, Messrs. Stanes and Co's premises have increased. They are replete with every convenience, and machinery is largely employed. The amiable head of the firm, Mr. Robert Stanes, will readily permit an inspection of the various buildings by any one desirous of making himself acquainted with the processes through which our coffee passes before it is fit to be placed in the Home market. We, however, proceed to describe these works for the benefit of those who cannot make a personal inspection. In a line with Messrs. Stanes and Co.'s office, is a series of godowns, into which the crop of each estate is received as delivered, and preliminary to exposure on the barbacues to be dried. On the arrival of a consignment, a careful comparison between the invoice and the delivery is instituted by a responsible officer of the works in the presence of the man who goes in charge, who, after measurement, obtains a receipt for the quantity delivered. When dried, the parchment coffee is conveyed in bags to two circular peelers, worked by a stationary engine. These peelers are fed at the rate of about eight bushels each, per every three minutes, and between them deliver from sixteen to twenty tons of peeled coffee per diem. The husk, which ultimately goes to feed the engine is removed by a winnowing machine adjacent, after which the coffee is emptied into a rough sizer. From the sizer it is carried up an inclined plane to a spacious upper-storied room, in which from 200 to 600 women and children, seated at dwarf tables, are busily employed picking out the broken coffee. The people are paid from a few pice to about two annas and a half, according to age and experience, per diem, and some of them have been employed upon the works ever since they were established. It was interesting to learn that girls who accompanied their parents to the works, fifteen or sixteen years ago, were now themselves mothers, and led their infants in like manner at the present day. On the same floor with these people is the final sizer, which delivers in the lower story, in five assortments, classed A., AA., B., C. and Peaberry. The coffee is here packed in cases, and is ready for shipment. The arrangements for storage and safe custody, seem to be as satisfactory as it is possible to make them, and are well calculated to guard against theft or misappropriation. A European patrols the premises during the night, and the people employed upon the works are every evening challenged by a European porter and, if necessary, searched by a female attendant. A couple of watch dogs are now on their way out intended for this firm, and on the arrival of the dogs, the property of its constituents will be as safe as the firm can possibly make it. The experience of the past year has shown that the natural shrinkage of the coffee on exposure on the barbacues at Coimbatore has given rise to some doubts as to the efficiency of arrangements for the safe custody of crop sent to the works to be cleaned, and some recriminatory correspondence has been the result, but it will be seen from what we have said that Messrs. Stanes and Co, do their best for their constituents in this respect, and that the

discrepancies in measurement are the result of natural causes. Other curing agencies have had a similar experience. So unfavorable was the weather last year, during crop time, that one planter told us he was obliged to despatch to Coimbatore from five to six tons of parchment per day taken directly from the vats. It was, of course, impossible for these consignments to be the same in bulk when dried as when delivered in a reeking state.—*South of India Observer.*

SERICULTURE.

NEWS comes from Japan that the silkworm season has been a very disastrous one for the growers.

SERICULTURE is rapidly progressing in the Southern States of America. Only three years ago Mr. Samuel Lowery, a coloured lawyer of Huntsville, commenced the raising of silk worms, which proved very healthy. Mr. Lowery has now a number of mulberry trees planted, and will have for sale this spring from 4,000,000 to 5,000,000 of eggs, worth about \$6·50 per ounce, or \$1 per 100. He thinks that the cost per acre of silk culture would be about the same as that of cotton, and estimates the product as from 150 to 200 lbs. of silk per acre, worth from \$4 to 6 per lb.

THE exports of chussum (waste silk) from Calcutta since the commencement of the official year 1876-77 have been as follow :—

			Quantity LBS.	Value RS.
1876-77	To Foreign Ports	...	659,755	417,692
	„ Coast Ports	...	78,518	71,626
1877-78	To Foreign Ports	...	822,640	604,876
	„ Coast Ports	...	46,116	36,673
April to Sep. 1878.	To Foreign Ports	...	399,948	306,017
	„ Coast Ports	...	22,144	15,360

The exports of all raw silk including chussum were—

1876-77	To Foreign Ports	...	1,410,372	77,48,843
	„ Coast Ports	...	372,091	17,61,351
1877-78	To Foreign Ports	...	1,491,950	70,20,331
	„ Coast Ports	...	634,888	41,93,852
April to Sep. 1878.	To Foreign Ports	...	690,386	71,04,547
	„ Coast Ports	...	247,790	14,12,296

The difference between the value of ordinary raw silk and chussum is so great that, having regard to the extent of the trade in the latter article, it is possible that wrong inferences may be drawn from the figures in the trade returns where the exports are added together, undistinguished, under the head of Raw Silk. The Governor-General in Council has accordingly directed that in future, chussum and cocoons shall be shown separately in the returns of the sea-borne trade.

THE WILD SILK INDUSTRY OF INDIA.

TUSSER silk has long been known and used by the natives of India. They have exported it in considerable quantities of late years, but from their imperfect mode of manipulating it in its earlier stages of manufacture, and from the difficulty of dyeing it well, it has made but little way in Europe except for ladies' and children's dresses in an undyed state. In Bengal and the adjoining provinces from time immemorial the natives have manufactured this silk into cloth called "Tussor dhooties," which is worn by Brahmins and other sects of Hindoos. In 1858, Dr. Birdwood brought the wild worms under the notice of this country, and urged their utilization. The silk is found from the north-west range of the Himalaya, south as far as Midnapore, in Bengal, and through the north-east range to Assam, and southward to Chittagong, and probably further. It is found also in the Presidencies of Bombay and Madras, and is said to be abundant in Bhagulpore in Bengal. It abounds chiefly in the eastern districts of Chattisgarh, namely, Raipore, Bilaspore and Sambulpore, in the Chanda district of the Nagpore province, and the Leono district. The natural colour of the silk is a darkish shade of fawn, much unlike the golden and white colours of the mulberry-worm silks. It has much less affinity for dye stuffs, especially for those which grow in India, and it has not until recently been much dyed. For several years I have been engaged with considerable success in improving the methods of dyeing, and the results are shown in a case at the Paris Exhibition. These improvements in the manufacture and dyeing are likely to have a very great influence on the cultivation of this silk, and probably also of other wild silks, the demand for which may in a few years be only measured by the quantity which can be produced. The larvæ of the Tusser, when fully grown, are about four inches in length; they have twelve joints or articulations, besides their extremities. Their colour is green, resembling the leaves on which they feed; and they are marked with reddish spots and a reddish yellow band running lengthways. They feed on several plants :—

Rhizophora calceolaria. Linn.
Terminalia alata glabra (Assum tree).
Terminalia tomentosa (the Saj tree).
Terminalia Catappa (Country Almond tree).
Tectona grandis. (Teak tree.)
Zizyphus jujuba, (Ber tree.)
Shorea robusta. (Sal tree.)
Bombax heptaphyllum. (Semul.)
Careya sphærica.
Pentaptera tomentosa.
Pentaptera glabra.
Ricinus communis (Castor oil plant).
Cassia lanceolata.

In six weeks from the time they are hatched they begin to spin their cocoons, which they most curiously suspend from the branches of the trees by constructing a thick hard cord or filament of silky matter, which is made to grasp the branches. As soon as the worm has spun its cocoon it takes the form of chrysalis or pupa, and remains a prisoner in the cocoons for about nine months, or from October until July. At the end of this time the chrysalis assumes the form of a moth, and whilst its wings are in an imperfectly developed state it softens one end of the cocoons with an exudation which enables it to separate the filaments of silk and to work its way out of the cocoon. This it effects during the night. The weight of the ordinary Tusser cocoon, with its pupa enclosed and the cord by which it is attached to the branch, is about five grammes. The Tussur moths are known under the following names :—

Antheraea Paphia (Linnæus).
Bombyx „ (Hübner).
Saturnia „ (Helfer).
Phalæna Attacus Mylitta (Drury).
„ Paphia (Roxburgh).
Bombyx Mylitta (Fabricius).
"Bughy" of the native of Burbhoon Hills where the silk (which the same people call "Tusseh") is manufactured.

The male is of a reddish pale brown colour, and the female much yellower. Mr. O'Neil in his report says :—"The moths are particularly revered by the people engaged in the culture of the worms, the occulili on their wing being considered as the 'chakra' or mark of Vishnu. These people also pretend to observe the greatest purity of life during the time they are in the jungles rearing the worms, and do not eat flesh, fish or spices, do not shave or cut their hair, do not wear washed clothing, nor anoint their bodies with oil, and do not touch any person of whom a relative may have recently died." Organzine and Tram Tusser are shown of the quality and state of manufacture now used in England for weaving, and a good representation of the present state of its manufacture which gives a size of 255 deniers (15 drams per 1,000 yards). The sizes of the Tusser silk generally used in England run from 152 deniers (9 drams) to 255 deniers (15 drams). These are very coarse sizes and must necessarily be unfit to produce such fine textile work as the mulberry silk which is manufactured into Organzine and Tram of 21 deniers and upwards ($1\frac{1}{4}$ drams) and from which are made the finest silk fabrics. The want of fineness and quality is owing to the imperfect and unskilful mode of manipulating it from the cocoon upwards in India, and the want of better machinery to prepare it in the raw state. The improvement in quality, fineness, and cleanness in the Organzine Tusser manufactured, &c., under my own instructions and superintendence will be seen to be most marked; instead of the coarse sizes of Tusser now used, of 152 to 255 deniers (9 to 15 drams), there may be obtained by proper management, Organzine and Tram of excellent quality from the same cocoons of 51 deniers (3 drams) and upwards, which can be woven into a great variety of stuffs, for which until now only the mulberry silks have been available. The attention of all interested in or connected with silk manufacture, cannot be too strongly drawn to this fact, nor its value be overrated. There is a most important future in store for the Tusser silk industry, and as great improvements will take place as those which resulted from the introduction of proper machinery

and skill many years ago, in the mulberry silk districts of Bengal, when it was found that Bengal silks, in place of being almost unworkable, could be manufactured in such a way as to bring them into extended use in Europe, so as even to rival French and Italian silks. The cost of making Organzine and Tram from the cocoons by the improved mode is about 20 francs per kilogramme. Mr. Neil, in his report (1875), says :—"The native contrivances for manufacturing silk are very simple, but improvement is required in the art of manufacturing silk fabrics." Now printed Tusser silk can be successfully used for wall damasks, curtains, furniture coverings, hangings, women's and girl's dresses, with great effect, and I would draw the attention of upholsterers and broad silk manufacturers to the specimens shown. The silk fabrics made of Tusser are very strong, most durable, and possess much lusture. The patterns printed in blue are the first successful application of indigo on silk as a print, and not as a pencil blue. They will prove remarkably fast, in fact none of the colours are printed in aniline or any other fugitive dyes. Notice the rich tone of blue they bear, modified to some extent by the ground colour which has controlled too great a brightness. The *Attacus Cynthia*, a wild silk-worm of India, produces the silk known as Eri or Eria of Assam.

It is also known under the following names :—

Phalæna Cynthia (Roxburgh).
Bombyx Cynthia (Olivier).
Samia Cynthia (Hubner).
Saturnia Cynthia (Westwood).
Saturnia Arrundi (Royle).
The Arrindi or Arrundi silk-worm moth (Roxburgh).

With this I must connect the *Attacus Ricini* (Boisduval), the same insect so far as I can gather, except that it is fed on the *Ricinus Communis*, or Castor Oil plant, and is reared in a domesticated state in Assam, and over a great part of Hindustan, more especially in the districts of Dinagepore and Rungpore. Mr. Hugon gives the following interesting particulars respecting it : "The larva when at full size is about $3\frac{1}{2}$ inches long. It spins its cocoon in four days. The hill tribes settled in the plains are fond of eating the chrysalis." The cocoon is much smaller than that of the Tusser and is soft. The natives cannot wind the silk, but spin it like cotton Dr. Helfer says the insect is so productive as to give sometimes twelve broods a year, and that the worm grows rapidly and offers no difficulty whatever for an extensive speculation. Mr. Atkinson says the filament is so delicate as to render it impracticable to wind off the silk ; it is therefore spun like cotton. The yarn thus manufactured is woven into a coarse kind of white cloth, of a seemingly loose texture, but of incredible durability, the life of one person being seldom sufficient to wear out a garment made of it. The winding of the Eria cocoon is said to have been recently accomplished ; the thickness of the Eria filament is $\frac{1}{1500}$ of an inch. Leaving the question as to whether it can be successfully wound or not, one important consideration respecting its use presents itself, namely its capability of being spun like cotton and wool. The great improvements made in late years in England in spinning machinery have proved that marvellous results in making an even thread from waste silk and unwindable cocoons, for sewing and weaving purposes, may be attained, and I will venture to predict a future for this and the produce of all unwindable silk-worm cocoons that will compensate for their collection. The industry of the natives should be stimulated to the gathering in of all kinds of wild silk cocoons, whether windable or not, for there is no doubt that those kinds which cannot be wound can be most easily spun, and there is at the present moment a demand on the part of silk spinners for a larger supply of Tusser silk cocoons and Tusser silk waste for spinning purposes, and no doubt other silk cocoons would be gladly bought up.—*Thomas Wardle, F.C.S., F.G.S., Leek.*

THE ROYAL BERKSHIRE ROOT SHOW.

On Saturday some 17,000 persons visited the seed stores of Messrs. Sutton and Sons, at Reading, to view the 29th annual show of roots grown by customers of the firm in almost every county in England and Wales and also in Scotland. Among the company were Viscount Eversley. Colonel Loyd-Lindsay, V.C., M. P, Mr. Walter, M.P., Mr. P. Wroughton, M.P., Mr. J Shaw-Lefevere, M.P., the High Sheriffs of Berkshire, Oxfordshire, and Buckinghamshire, and M. Alfred Dudoiy, Commissioner from the Société des Agriculteurs de France.

Nearly 1,600 entries were in competition for the prizes, amounting to £300, including specimens contributed by the Queen, the Prince of Wales, the Dukes of Northumberland and Portland, the Marquises of Donegal and Ailesbury ; the Earls of Craven, Warwick, Redesdale, Northbrook, and Bathurst ; Lords Calthorpe, Camoys, Chesham, Eversley, Keir, Moreton ; the Countess of Yarborough, Sir W. Heathcote, Sir G. A. C. East, Sir C. M. Lampson, Sir C. Russell, M. P., V. C., Sir Paul Hunter, Sir C. F. Smythe, Colonel Lloyd-Lindsay, V. C., M. P., Mr. Walter, M. P., and the Right Hon. W. H. Smith, M. P. As a result of a careful inspection, we may say that the extraordinary feature in the Show is the absence of any commonplace specimens throughout the whole of the classes, while the general standard of weight and quality, particularly in the classes of mangels, white fleshed turnips, and parsnips, has never been equalled at any other exhibition. The mangels occupied the floor of the main room, which is spacious enough to seat 5,000 people, and the judges had great difficulty in deciding the principal prizes, so close and meritorious was the competition.

The heaviest mammoth long red mangel weighs 47lb, and measures 3ft. in length ; the heaviest yellow glove weighs 38lb., the heaviest golden tankard 39lb., and others in equally remarkable proportions. The champion prize, and gold cup value £20, for the best 36 mangels is taken by Sir Paul Hunter, of Mortimer-hill, whose roots are of the following remarkable weights :—Twelve mammoth long red 406lb., twelve golden tankard 379lb., twelve yellow globe 315lb. One of the most remarkable exhibits is a collection of several hundred roots grown on Reading Sewage Farm this year, and drawn from a crop of 50 acres. Finer specimens have seldom been seen, and the whole crop is the heaviest field crop on record, as the following weights will show :—Sutton's mammoth long red, 119 tons per acre, on seven acres ; Sutton's golden tankard, 88 tons per acre ; Sutton's Berks prize yellow globe, 77 tons per acre ; and Sutton's yellow intermediate, 77 tons per acre.

Cabbages are shown weighing over 56lb. each, and a gourd attaining the enormous weight of 162lb. The winners of the chief honours were, for mangels, Sir Paul Hunter, Mr. R. Burn-Blyth, Sir F. Smythe, Mr. Richard Webb, Messrs. J. and W. H. Clarke, and Sir Richard F. Sutton ; for swedes and turnips, Mr. J F. Burroll, Mr. H. Middleton. Mr. J. S. Calvert, Colonel Loyd-Lindsay, V. C., M. P., Mr. W. Willis, Mr. Charles Keep, Mr. W. Hobbis, Mr. J. Bramstone Stone, Mr. J. H. G. Love, Mr. H. Palmer, Sir Curtis Lampson, Mr. R. Lees, and Mr. W. Townsend ; for kohl rabi, Mr. W. Beale, and Mr. Thomas Aitken ; for cabbages, Mr. S. Robinson and Sir Paul Hunter ; for white carrots, Sir Paul Hunter and the Hon. Mrs. Hay. Among the collections of potatoes the most superb show is that of Sutton's Magnum Bonum variety.

The judges were—Mr. J. Brebner, her Majesty's Norfolk Farm, Windsor : Mr. W. Brignshaw, her Majesty's Bagshot Park Farm ; Mr. James Buckman, Professor of Agriculture ; Mr. J. Chalmers Morton ; Mr. H. Simmons, Bearwood Park Farm, Berks ; and Mr. H. Tait, her Majesty's Shaw Farm, Windsor—for roots ; Mr. C. Penny, gardener to the Prince of Wales, Sandringham ; Mr. J. Tegg, gardener to Mr. Walter, M. P., Bearwood ; and Mr. Coombes, gardener to Mr. R. Benyon—for potatoes and vegetables.—*Times*, November 25th.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.]. CALCUTTA: SATURDAY, 1st MARCH, 1879. [No. 3.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price*

R. KNIGHT.

Calcutta, 1st Feb 1876

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

LETTERS TO THE EDITOR.

TUSSUR SILK.

TO THE EDITOR.

SIR,—Silk is an article that well deserves the attention of governments, land owners, manufacturers and commercial men. I purpose proving this upon authentic data, and at the same time of shewing clearly a special source of wealth in connection with it that India alone possesses.

Whether from the more general consumption of those products that indicate and follow the standard of civilization amongst the middle classes, or owing to the repeated blights of the mulberry tree, there has been in Europe during the past 50 years an increasing disposition to resort to foreign sources of silk supply to replace the home consumption. Asia, especially China, Japan, and India, has been the most turned to account to satisfy the European demand The Tussur, however, is one amongst the many kinds of cocoons, that it would be well to study as the possible and sound substitute for those of the mulberry tree—conforming as it does in some of its special characteristics. It is bright and elastic, while its strength of tissue admits of the thread being diminished in the winding off, without losing any of the qualities required by the dyer and the loomsman. The better to acquaint my reader with the production and consumption of silk throughout the world, I submit for his consideration a table compiled from the statistics of the Italian Government

Produce throughout the world of the different silks from the mulberry tree cocoons.

		Nations.	Kilogrammes.	Total	European consumption	REMARKS.
	Kilos	China	7,500,000	Asia ..	3,000,000	Accepting the statistics of Mr Richter the production of Italy would be 4 millions, others shew the yield to be 3 millions only, but the Italian Government acknowledges to 3,600,000
Of the rough silk of China there are		India .	2,000,000		500,000	
	3,000,000	Japan ..	2,000,000		700,000	
and of the tussur silk of India .		Russia .	1,000,000		400,000	
	2,000,000	Turkey .	400,000		350,000	
				12,900,000	4,850,000	
		Italy .	3,600,000			The mooga and tussur silks are not manufactured in Europe.
		France .	600,000			
		Austria	250,000			
		Spain and Portugal	150,000			
		Greece, European Turkey, &c., &c.	100,000	4,700,000	4,700,000	
Total .	5,000,000	Grand Total	. .	17,600,000	9,550,000	

N B—The average prices of Asiatic and European silks during 10 years have been respectively 50 and 65 *francs* the *kilo*. Thus the

4,850,000	Asiatic ..	@ 50 *f.*	=	242,500,000 *francs.*
4,700,000	European	.. 65 *f*	=	305,500,000 ..
Kilos ... 9,550,000			*Francs*	548,000,000

Italy does not manufacture in proportion to her large production Thus one finds that the number and distribution of the silk factories throughout Europe are as follows:—

In France		120,000
" England		120,000
" Germany	70,000	120,000
" Switzerland ...	40,000	
" Austria	10,000	
" Italy		12,000
Total of European factories ...		372,000

Italy holds in Europe the first place as producer; having no less than 4,805 factories at work upon her own productions (4,355 *à feu* and 450 *à vapeur*); while France has not more than about 900 factories devoted to the same purpose, of which the greater number are each fitted with 100 dimity looms (*basines*). But besides the silk from cocoons nurtured at home, she uses a vast quantity supplied from abroad. In the manufacture of silk dress materials and lace there is used of

Indigenous produce	30	per cent. of the total outturn.
Of Italian	22	" "
Of Asiatic	48	" "
	100	

To assure oneself that the use of silk is becoming more general among the middle classes and decreasing among the upper, it can be necessary only to consider the following table, showing the proportionate distribution of silk manufactures in France at different periods.

Sales effected during the years ...	1855.	1862.	1871.	1872.
The value of heavy priced goods in millions of francs was ...	39	30	9	14
The value of low priced goods in millions of francs was ...	142	193	294	308

In addition to these figures I will give the quantities exported, as shown by the French Custom House returns at various dates.

From 1827 to 1836	in millions of francs ...	121
" 1837 " 1846	" ...	134
" 1817 " 1856	" ...	274
" 1857 " 1866	" ...	414
" 1867 " 1876	" ...	465

And still further to shew the changes undergone in France in the progress of this industry I give a table of the factories that have been at work during the past 200 years.

In 1684 ...	10,000	In 1823 ...	21,000
" 1705 ...	2,000	" 1827 ...	27,000
" 1788 ...	18,000	" 1831 ...	42,000
" 1793 ...	3,500	" 1848 ...	50,000
" 1810 } 1815 } ...	12,000	" 1852 ...	65,000
		" 1864 ...	120,000

To sum up, there can be no doubt of the almost boundless consumption of silks of every kind, but, above all, of those that go specially to the manufacture of the materials that savour of democracy. Having formed an idea of the nearly limitless extent of the total quantity of silk used, I invite the reader to think of the wealth that India might possess, would she but increase the production of tussur cocoons. If the industry were left altogether in native hands the result could only be applied to the manufacture of the course material known as tussur cloth. The present outturn would in that case be enough; the two harvests that fall within the year would sometimes even more than supply the demand. But since we have found the means of winding off the tussur silk as finely as that from the cocoon of the mulberry tree itself, it seems to me wrong that this natural resource should be neglected. Government, in the first place, and the land owners, in the second, should encourage its nurture—nature would repay the encouragement manifold. The tea and jute enterprises have proved the wisdom of leaving in native hands the growth of natural produce—with the help only of the needful European capital and supervision. So far as Government is concerned, it might cultivate the tussur cocoons by the system now applying to opium, but with a tenth of the trouble. Consider for a moment the multitude of trees to be found amidst the jungle that will nourish the tussur silk-worm. Oaks of all kinds—Terminalia pentaptera tormentosa, Zizyphus jujuba, Ficus binnaminas, Ficus religiosa, Carissa, Grudia, Wrightia, Terminalia catappa, Terminalia alata, Bombax hopthaphyllum, Shorea robusta, Carea sphacria, Hagerstiauvia carviflora, Canocarpus latifolia, Pentaptera Arjuna, Syzyguim jambutanum, Tectora grandis. I will not dwell upon the simple treatment needed by the silkworm while in the tree, that supplies it, with all necessary nutriment. Almost all it needs is that the birds shall be kept away during the 35 days that constitute its life. The cocoon is completely formed in 8 days, and all who have experimented on its cultivation have proved that the cost of fresh materials of production would not be more than 14 to 15 annas per 1,000 cocoons. Say a rupee, however, yet it must always be satisfactory to produce for one what may be sold for four rupees. The latter price is the one commonly accepted for the small supply of silk yet produced, but it might be realized for all that India could produce—would she but encourage the industry. It must be seen at a glance that the cultivation would become no less valuable than that of opium, and that it could be adapted without difficulty to the jungles of India.

If more extended information be wanted regarding either the nurture and treatment of cocoons or the mode of preparing them for the market I shall be happy to furnish it; or to render any other assistance that may be in my power.

F. L.

MODEL FARMING.

SIR,—I have been recently perusing some amusing articles on the attempts made in various parts of India in model farming; they all seem to be intended to teach the native ornamental gardening or high farming. For many years any such attempts must be failures. For anything to be taught must be begun in its elements before higher things are attempted; and what is required is to demonstrate to the native mind that 100 acres worked by paid labor and better ploughing would be more profitable than 10 acres worked by his own labor; and that certain crops yield a better return than inferior ones. Now the staple produce of India is wheat and rice. The production of the first in greater quantities should be encouraged, and rice, as now planted, is broadcast and re-planted, costing great labor. An attempt might be made to introduce Carolina rice. With the hoe it can be planted at once, as it is planted in ridges and needs less watering than the Indian rice, and does not require transplanting. And secondly, the natives should be taught the use of the American plough, with which some experiments have been made at the Central Jail, Calcutta, with great success: it seems to be well adapted for India, and costs a moderate sum. The great defect of the Indian plough is that the ground has to be gone over five and six times before it is fit for use; and the introduction of a better kind of harrow is required. What model farms should aim at is to show the natives the advantage of better tools, and the most remunerative crops. Of course inferior crops will be raised, as they form the staple food of the natives; but if they could get wheat or rice cheaper they would prefer them.

PHILO.

Calcutta, 23rd February, 1878.

DE OMNIBUS.

SIR,—The weather during the past month has been unusually dry, in fact to such an extent has this been the case, that I much doubt whether we shall obtain more than a three-quarters crop of cereals. Although if this dry weather continues, there is no doubt but that this proportion will be further lessened. This does not mean a famine, (though I dare say the local officials would like to have a famine for the grist it brings to such gentry) as the people have sufficient to tide them over until harvest time, though it does mean a temporary tightness in the price of food grains. If Providence is merciful and sends "such moderate rain and showers that we may receive the fruits of the earth to our comfort, and his honor," the rainy season crops ought to be bumper ones, as the ground will have had a slight rest and double ploughings which will have given it a large supply of light and air.

Subjoined is an abstract of some meteorological observations kept during the past five years.

JANUARY.

	1875.	1876.	1877.	1878.	1879.
Snowy days ...	2	2	5	3	1
Haily " ...	—	—	—	—	—
Rainy " ...	—	4	4	2	—
	Dry.	Dry and warm.	About 31 inches of snow.	Suitable	Excessively dry only about ¼ of an inch of snow.

The wind is generally from western quarters bringing up the vapours, which fall either in snow or rain.

Themometer (Fht.) hung in open verandah about 39 at 7 A.M., and 50 at 6 P.M.

Grass and jungle burning—those curses of the country—progressing with the usual vigour, thus burning up seedlings and keeping the sides

of the mountains quite bare of arborescent vegetation. The present drought may be in great measure laid to this sinful proceeding. It is simply a sign that the graziers have too large an area of grazing ground as grass-land, properly fed down or harvested, needs no firing, and what is more to the point new grass will spring up much quicker where the two former operations have been carried out than on the latter. *Verb. sap.*

Owing to the dryness of the season the cotonifolium fœteus, apple and cherry trees have not yet come into blossom. The buds of many trees, such as the willow, peach, walnut; rhododendron are now swelling. Should they come out too early and cold sharp windy weather set in afterwards, great loss will be the result. The chekul (*Prinsepia utilis*) with its wee white flower, the wild oleander (*Nerium oleander*) with its white wax-like, (though so pretty, nearly every part is poisonous) are our principal flowering shrubs: of wild flowers we have a few cistus with their yellow petals, violets (scentless at low elevations and in exposed situations) and buttercups in sheltered and moist situations, there are a few ferns.

The sportsman can now obtain stags (*ral nembu*); musk deer (*kastúra bina*); barking deer (*khakkar*); chamois (*gural pif*) hare (*khargos*) porcupine (*shahai*) wild pig (*jungli sür*) bear (*balu rikh*) leopard (*bragh*) flying squirrels (*iin*) hill fox, pine marten, lynx, jungle-cat, wood otter, jackel, most of these require careful stalking, and for the sportsman to keep in the neighborhood of the snow just below which point most of the animals birds also, live or come down to, in order to obtain food, others are found about the fields and ravines; the bears can be killed in their dens with proper precautions.

Of birds we have pheasants, the argus (*thahi*) manaul (*minal*) long-tailed (*chir*); chockolate breasted (*kohlas plach*) silver breasted (*khallege*) partridges, olive (*bantitr*) black (*titr*); chakore (*chikor*); quail (*batere*) woodcock; pigeons, green, large blue, winter white breasted, and mottled breasted; all now in full winter, plumage. While down by the bank of the river there are the wild goose (*jungli raj haus*) wild duck and teal. Fish, the mahsir and a small kind of trout are caught in the river.

The crops now growing are wheat and barley.

Price of wheat 10 seers for the rupee.

Gardening operations confined to carrying out manure, transplanting fruit and other trees, digging and preparing ground. Mignonette, naricissus, red, pink, and white roses, petunia now in blossom; among vegetables are cabbages, turnips, carrots.

G. P. P.

Koteghur, 1st February 1879.

MR. ROUTLEDGE ON BAMBOO.

(*To the Editor of the Englishman.*)

SIR,—In your paper of 21st January, you printed a letter from Mr. Thomas Routledge, in which he comments on the ill-success of the experiment in cropping bamboos described in the report of the Botanic Garden for 1877-78. Mr. Routledge attributes the failure to my having followed a faulty system with the invention of which he appears desirous of crediting me. Now nobody can have a poorer opinion of the merits of the system which was followed in this experiment than I myself have.

The system is not, however, of my invention, but was suggested in a pamphlet entitled "Bamboo considered as a paper-making material," published during 1875, by no other than Mr. Routledge himself.

In his letter to you Mr. Routledge objects very strongly to the cutting of all the shoots of each clump of bamboo, and says my results were bad because I did this. In his pamphlet just named, Mr. Routledge described his scheme of growing and cropping bamboos in the following words:—

"The stems of the 'bamboo,' cut young, as I propose to use them, contain from 60 to 75 per cent. of moisture; it will be obvious, therefore, that to ensure a regular and continuous supply under economical conditions, to a central factory for the manufacture of 'paper-stock,' plantations would have to be formed contiguous thereto, as practised with 'sugarcane,' or in a similar manner to osier beds in England.

* * * * * * *

"With plantations of 'sugarcane,' to which plant the 'bamboo' somewhat assimilates in character and growth, it is necessary, in order to ripen the canes and develop saccharine, to allow free ventilation to the growing plant, and thus the ground is not fully occupied. This would not be the case with 'bamboo,' which should be planted and grown closely together to favor the stems shooting upwards, as practised with 'hemp' and 'flax,' where fine staple of fibre is desired.

"By following such a system, the stools or roots once established, a systematical and regular cropping, or cutting, would ensue, the stems being all cut down simultaneously, by sections or beds, in regular succession, numerous croppings annually would thus be obtained, and, when necessary, fresh beds would be formed, the older growth being avliable for fuel for the manufactory.

"The sugarcane from the time of planting to cutting takes from nine to twelve months to grow and mature; but even thus grown, the produce of canes (ready dressed for the mill) generally ranges from 30 to 35 tons to the acre; it sometimes exceeds 40 tons; allowing several crops and cuttings annually for the 'bamboo,' it may fairly be assumed that at least this latter quantity would be obtained per acre.

"Allowing 208 feet square to represent one acre, divided into twelve beds, each 96 by 26 feet, with twelve paths 96 feet, 8 feet 8 inches wide, and one intersecting road 208 by 16 feet wide, leaves a space for planting equal to 2,496 feet, or 29,952 feet in the twelve beds; allowing the stems to be 2 feet apart, and say only 12 feet high, we have 7,488 stems, which at 12 lbs. each. equals 40 tons per acre."

It appears to me impossible to understand anything from this extract, but that the writer of it intended all the shoots of each clump to be cut, inasmuch as in his calculation of the annual outturn of an acre he includes the weight of every stem grown on that acre.

The plan of cropping thus proposed has always seemed to be perfectly Utopian, and I have expressed my opinion of it freely enough in more places than one. For example in a paragraph of the report of the Botanic Garden, in which the experiments were described I wrote as follows:—

"Mr. Routledge's expectations imply a very complete change of habit in the bamboo; for it is pretty well known that bamboo clumps, entirely cut down, yield for several years but few and small succulent shoots, and in fact not unfrequently die."

However, as Mr. Routledge's project for cultivating bamboo in the way described in his pamphlet was being pressed with some persistence on Government, I felt bound to put it to the test of actual experience. I did so with results that have so vexed Mr. Routledge that he now tries to throw the discredit of them upon me. I am quite ready to accept Mr. Routledge as an authority on the probable value of young shoots of bamboo as a paper fibre, and to admit that paper stock derived from them may one day become an article of export from India. But I hardly think the latter result is likely to be any the sooner brought about by attempts to deny the paternity of an inappropriate scheme so soon as its inappropriateness shall have been practically demonstrated.

The plan of cropping which I understand Mr. Routledge now to recommend is that only a few of the young shoots be taken from a bamboo clump each season, and that the other shoots, both young and old, be left uncut. So far as the plants are concerned there would be no objection to this system. But I fail to see how it could be carried on to a profit in this part of India. According to Mr. Routledge, five shillings per ton is the price which could be allowed for young bamboo shoots delivered at a paper stock factory. No doubt bamboo grows in enormous quantities in remote districts where it could be had for little more than the cost of collection, and where there is excellent water-carriage. But, unfortunately, bamboo shoots at the stage of growth required for Mr. Routledge's process are of higher specific gravity than water, and could not be rafted without more or less expensive arrangements for floats. The cost of boat hire from these remote regions to a factory stationed in a civilized place would probably in most cases bring the raw material to far more than five shillings a ton, while cartage is out of the question. There remains Mr. Routledge's plantation scheme in its new form by which only a portion of the annual shoots are to be cut. This means irrigating, manuring, and paying rent for an area of land of which only a part of the annual yield can be cut as crop. And these are by no means trifling items in Bengal. Moreover, mature bamboo stems are marketable at considerable rates in civilized districts, and it would probably be more profitable to growers to sell their bamboos mature, than to dispose of them in their succulent stage to a paper stock factory. Lastly, in putting down the annual yield of succulent shoots at 40 tons, or even at half of that per acre, Mr. Routledge is unwisely sanguine. My own belief is that from an acre of *Bambusa Bulcooa* (one of the common species in Bengal) it would be difficult to collect annually as much as from 5 to 10 tons. I look on all proposals to bring this kind of raw material to a factory as less hopeful than the proposal to take the factory to the raw material; and if the production of paper stock from bamboo is ever to become an Indian industry, I believe it will be by fitting up floating mills and moving them about on rivers in the banks of which bamboo naturally abounds.

If Mr. Routledge would but direct his inventive powers to the problem of utilizing mature bamboo stems as a material for paper fibre, he would in my opinion be more likely to attain useful results than in continuing to propose schemes for the cultivation of a plant with the peculiar growth of which he seems to have had so little opportunity of acquainting himself. Ripe bamboo stems are the most buoyant of all forest products, and a practically unlimited supply of these could

at a low cost be floated by river from Assam, the Chittagong Hill Tracts, and other districts. I am told that in Japan and China, paper is made from mature bamboos, and, if such be the case, I suppose the same could be done in England.

GEORGE KING.

Botanic Garden, Howrah, Feb. 3, 1879

BAMBOO IN THE BOTANICAL GARDEN, CALCUTTA.

(*Remarks in the annual report for the year* 1877-78.)

THERE is, unfortunately, no controverting the fact chronicled in the Report above referred to that the experiments on bamboo, in relation to its cultivation and cropping for the proposed manufacture of "Paper-Stock," conducted by Dr. King during the past two years, have resulted in utter failure.

The causes, however, of this failure are not far to seek; indeed, the system adopted during the first year rendered such a result nearly inevitable. It is now my desire to show how, with more recent investigation of the subject and more knowledge of the habit of the plant, more favourable results may not only be looked for, but, in suitable localities and climates, and with judicious management, ensured.

At an early stage of the question, in January, 1875, when I first brought the suitability of the bamboo for the manufacture of "Paper-Stock" under the notice of the Secretary of State for India, it was suggested I should address Dr. King on the subject. This I did *in extenso*, stating what I proposed, broadly giving him my views, but, being neither horticulturist, arboriculturist, nor scientific botanist, I did not profess to lay down any hard and fast line, but confined myself to describing the condition of the bamboo stems I had found best suited for my purpose, requesting Dr. King's opinion upon certain doubtful points bearing upon the best system of propagating and cropping the bamboo, inasmuch as at that time, but little being known of the plant in England, I could only glean very scant information; of course every body knew bamboo abounded in tropical countries, but I could learn but little as to its habit, and still less as to its cultivation, if indeed it ever had been cultivated.

A month or two later I published a pamphlet * on "Bamboo considered as a Paper-making Material" printed on paper I had made, at our Works here, from bamboo stems I had received from Demerara; in it embodying my views and generally stating the manner in which I judged, from analogous herbaceous growth, plantations to supply the young stems might be formed under irrigation.

This pamphlet was extensively circulated in India, through the India Office. I also, by desire of Lord Salisbury, sent out to Calcutta a box containing a selection of samples of stems of bamboo cut at the stage of growth I had found most suitable, as well as some for comparison which were too old and woody for my purpose.

This was followed in July, 1875, by a printed Memorandum, issued by Dr. Brandis, the Inspector-General of Forests (who appended there to extracts from letters I had addressed to him), admitting the importance of, and generally treating on the leading features of the question.

In February, 1876, a second Memorandum was issued by Dr. Brandis, in which he directed attention to the main points to be determined by the experimental plantations then ordered to be established by the Government of India. From this Memorandum I extract the following :—

"A method of treatment must it possible be discovered by which a "plantation, or natural forest of bamboos, may be made to yield a "succession of complete crops of young shoots throughout the year. "Our present experience is that a large proportion of old stems is "required in a bamboo clump to produce full-sized shoots, but it may "be that different species behave differently in that respect, and that a "larger proportion of full sized young shoots may be produced by "certain species, or by covering the roots with earth, manure, or "leaves, or by plentiful watering. Under ordinary circumstances, if "bamboo clumps are cut over in the forest, *all mature stems being cut* "*down at one time, the result is a crop of slender stems.* It requires "no experiments to establish this result. * * * * The experiments "undertaken *should as much as possible be comparative.* Of a number "of clumps of the same age and species, and growing under the same "conditions, *some should be thinned lightly, others heavily, and the third* "*group should be cut over completely, leaving only a few old stems on* "*the ground.*

"Again, experiments should be made in order to determine whether "cutting bamboos at different seasons has any effect upon the production of young shoots, and whether the production of young shoots can "be stimulated by selecting the stems to be cut according to certain "principles. Irrigation, manure, and covering with a layer of moist "earth, must in all cases be employed, with the view of inducing if "possible the bamboos to form a large crop of full-sized "shoots."

Now what occurred in the experiments conducted at the Botanical Gardens, as described in the Report?

"Six clumps of *Bambusa balcooa* were cut down at the beginning of "the rains, *between the 10th and 20th June, 1876*, when the buds "of the young shoots of the season had completely formed and "were nearly ready to burst through the soil. Soon after the cutting of "the old stems these buds developed into shoots, which grew with "characteristic rapidity. These were allowed to grow until they began "to show symptoms of becoming hard, *and on 21st July they were all* "*cut down.* In the beginning of the rainy season *last year* (*1877*) the "brushwood of thin woody twigs which had been produced by each "clump *was cut off*, but amongst the twigs there were none of the soft, "succulent shoots proceeding from the underground stem which are "required for Mr. Routledge's process. The clumps have just again "(10th July 1878) *been cleared of every twig* produced by them since the "previous cutting. The result is that, just as last year, the most of the "growth consists of hard woody twigs, which proceed from the bases of "the stems cut two years ago, the total yield of materials being 120 "pounds, or an average of 20 pounds per clump."

Under such treatment, as Dr. King correctly remarks, "*the proposed* "*new industry does not present a hopeful financial aspect.*" Verily it does not.

It is to be deplored that Dr. King did not follow the plan set forth by Dr. Brandis by treating each of the several clumps on a separate and comparative system, instead of adopting the "*heroic operation*" of cutting down not only *all the stems, both old and young, but even the young twigs*, on every separate clump, this being the more surprising as Dr. King *himself remarked* in his report published for 1876: "*for it is pretty well known that bamboo clumps, if entirely* "*cut down, yield for several years but small shoots, and not unfrequently* "*die.*" It would almost appear that the system adopted was to make assurance doubly sure, and prove a foregone conclusion.

The first intimation I had of Dr. King's experiments was by the publication of his report for 1877 in the *Journal of the Society of Arts* of the 2nd November, and I commented thereon in two letters also published in the Journal of November 16th and 30th.

Having now discussed *cause* and *effect*, I will proceed to show how, under a different system of cropping and treatment, the experiments conducted by Dr. King would certainly have shown a mere favourable result, and this by quoting the opinions of well-known botanical authorities well acquainted with the habit of the bamboo.

The accepted text book on bamboo is the Monograph of the Bambusaceæ by General Munro, C. B., published in the transactions of the Linnean Society. General Munro did me the favour to reply to queries I had transmitted to him as follows, September 8th, 1876:

"I have never heard of the bamboo being cultivated for successive "cropping, but I can see no reason why a regular systematic cropping "could not be carried out.

"*Bambusa vulgaris* would in my opinion be the best species to "cultivate, as it grows very readily from cuttings, so does *Dendrocalamus* "*giganteus*, which thrives remarkably well and grows fast in Trinidad, "and would, I think, produce the best fibre; *Bambusa tulda* would "be a good species in India; *Dendrocalamus strictus* also grows fast "and is easily propagated. The ordinary bamboo very rarely seeds in "the West Indies; I only saw it once in Jamaica; it is always increased "by cuttings. I do not think these should be put in at a less distance "than five feet apart; a fair sized bamboo will produce from 10 to 20 "shoots a year in moist countries.

"With reference to cutting and cropping, I should think 6 *or 7 out* "*of 10 shoots might be cut yearly* without causing any serious harm to "the parent stool; the older stems might be cut down in their second "year and serve as fuel. I should think the stools would continue to "produce fresh stems for about 30 years, about when the plants would "be likely to come into flower, and then die."

The late Mr. Sulpis Kurz, of the Botanical Gardens, Sambulpore, whose most interesting papers, "Bamboo and its Use," were published in the *Indian Forrester*, replied to queries I addressed to him—

"Regular cropping can be made only in so far as the shoots of every "rainy season can be cut down. If all the shoots be cut down, the stock "will be impoverished and ultimately die off, hence a certain per centage, "say one-fourth, of the whole of the stool would have to be spared. "The most common way of planting bamboo by natives is by taking "shoots, or the lower piece of the balm, with a part of the rhizome, and "plant during the rains; the intervals between the cuttings being "regulated by the size of the bamboo. Twelve to fifteen feet would "be a dense growth for the larger kinds, 80 feet and upwards in height,

* Bamboo considered as a Paper-making Material, by [illegible] Routledge. E. & F. N. SPON, London, 1875.

"which throw up from 15 to 20 shoots, wh... to 10 feet is the minimum "for the smaller kinds ab... ... feet: smaller kinds are not recommend- "able."

... Parish, a botanist well-acquainted with Burma and the Tenasserim Provinces, wrote me October, 1877 :—

"The shoots should *not all* be cut every year, for if this were done the "root-stock would die—only about half the clump should be cut yearly. "The bamboo once established as a strong root-stock, you can go on "cutting annually. As to the calculation of 7,488 stems per acre (*vide* "my pamphlet, p. 8), I should think that if only half were cut, a much "greater number could be got off an acre."

Numerous other correspondents have written me to the same effect as the foregoing, chiefly, however, from the West Indies.

Sir Joseph Hooker was good enough to send me a copy of a letter addressed to him by Mr. Robert Thomson, Government botanist and superintendent of the successful cinchona plantations in Jamaica, which, with permission, I published in the *Journal of the Society of Arts*, January 4th, 1878, as also, March 1st, another letter I had received myself from Mr. Thomson, to whom I had written for more detailed information. These two letters I append to these "remarks," as also a further Report from Mr. Thomson recording his later investigations of existing growth of bamboo in Jamaica, detailing its condition after a course of severe cropping. Having sent the *Society of Arts' Journal* containing Mr. Thomson's letters, to Dr. Berthold Ribbenthrop, Conservator of Forests, British Burma, requesting his views thereon, under date, August 8th, 1878, he replied :—

"There is no doubt that in fire-protected plantations a much larger "crop can be obtained than in the open forest exposed to constantly "recurring jungle fires. The bamboo jungles near villages on the Pegu "choung prove that constant cutting does not materially affect the "reproduction, and cutting the stems down within a couple of feet "from the ground maintains a perfect unimpaired action of the roots "as may be observed on the bamboo hedges in Rangoon. At the same, "time, I cannot agree with Mr. Thomson that a bamboo plantation "may be kept up indefinitely in regard to time, at least not without "re-stocking. This has been the case with the artificial plantations of "*Dendrocalamus Brandisii* here in Burma, the original stocks of "which die after about 60 to 70 years; others would doubtless be "shorter lived. The *Dendrocalamus Brandisii* plantations in Burma "are kept up by inter-planting with new stocks. Mr. Thomson's "system is doubtless the correct one. To grow bamboo like sugar-cane, "and to replant after cutting the crop, seems to me impracticable, the "maturation of small bamboos taking at least two years, that of the "larger kinds five, six, and ten years.".

In September, 1876, instructed by Dr. Ribbenthrop, Mr. R. Whittall, Assistant Conservator, visited the Pegu forests to investigate the bamboo question, taking with him specimens of the stems similar to those I had transmitted to Calcutta, and he reported :—

"I repeatedly showed the specimens of suitable bamboo to "experienced bamboo-cutters, to decide the age at which "they had been cut. Without hesitation, and quite unanimously, "they pronounced the stems of suitable bamboo to be of "the kind called in these parts *talagu*," and to have been cut "at from six weeks to four months after sprouting—that is, to have "sprouted at the commencement of the rains; the unsuitable specimens "they equally pronounced to be ... about one year older than the "others. This in my opinion quite sets at rest the question of age, at "least for the present. Bamboos "*of the year*," then, are alone suit- "able; and bamboos of more than 12 months are too hard for the "purpose. The large majority of young bamboos seems to sprout at "the commencement of the rains and during the month of July, but "the presence of very young and tender bamboos, which is by no "means seldom noticed, shows that they sprout all through the rains.

"*One fact* I am able to state from my own observation is, that there "appears to be a far larger number of bamboos *of the year*, on those "lists of scrub bamboo jungle so often found in the vicinity of "Burman villages, which are constantly being cut and hacked about, "than in the unfrequented bamboo regions of the forest. I do not "mean to say that the more the old bamboos are removed the more "numerously do the new ones appear; but the fact nevertheless seems "to point to a free but not too heavy or exhausting cutting, giving a "larger number of new and vigorous shoots."

The following extract from a letter I received from Dr. Ribbenthrop has also an important bearing on the question :—

"All my observations regarding the growth of many species of "bamboo tend to prove that you are perfectly correct in your views, and "that by artificially irrigated plantations we can force the productive "power of bamboo stocks to a very great extent. On the Pegu choung "and the Beingdat the most luxuriant growth is found close to the "water-courses, where they are most severely cut for the bamboo trade. "The banks of the Attaran river are for upwards of 50 miles fringed "by a broad belt of large, dense-growing, but for general purposes "useless bamboos."

Major Seaton, the Conservator of Forests, for the Southern Division of Burma and the Tenasserim Provinces, has also informed, and written me to the same effect as the foregoing; and Dr. Brandis kindly sent me a report by Dr. Schlich, writing me as follows :—

"It will interest you to learn that there are about 1,800 square miles "of almost pure bamboo forest in the Arrakan division of British "Burma, within a moderate distance from the coast, and all accessible "by navigable streams. The following is the substance of Dr. Schlich's "Report" :—

"The bamboo forest covers by far the greater portion of the area of "Arrakan, extending over thousands of square miles. It is composed "of *Bambusa longispatha*, *Bambusa tulda*. All these bamboos have "flowered several years ago, and the ground is now covered with "seedlings, which makes the forest impenetrable. The writer of this "report had to travel in it for days, at the rate of half-a-mile an hour, "having four men (alternately two and-two) in front employed "in cutting a passage just wide enough for a man to pass "through. In many places this bamboo forest contains no trees at all, "but, as a rule, there are isolated trees scattered over it. The trees met "with were those of the green forest, as well as those of the dry forest, "the former, however being far more numerous. This forest is green "throughout the year, and jungle fires do not visit it except at the "time when bamboos have died."

I have quoted this last report to show the enormous abundance and prolific nature of bamboo in localities and under climatic influences suitable to its development. Mr. Thomson's letters, *especially his later Report*, singularly coincide with, and corroborate the views expressed in the foregoing extracts from other authorities, tending to prove that under judicious management there can be but little (if any) doubt that the bamboo can be produced both abundantly and economically in plantations which, once established, little or no cultivation would be required

I may add that I have been induced to publish these remarks to qualify in some degree, by the authorities I have quoted, the *somewhat premature conclusions* that otherwise might be deduced from the Calcutta Garden Report, the publication of which, as it has been disseminated officially, might be deterrent on those proposing to embark in the New Industry I am endeavouring to introduce, which I feel assured ere long will assume prominent proportions, as the difficulties and prejudices generally attaching to a new and comparatively unknown enterprise gradually disappear.

Strongly impressed with its importance, I am wishful to induce the fullest investigation of the subject, as should my views prove correct, not only will a fresh channel be created for the employment of native industry in India, but an important branch of English manufacturers be materially benefited.

THOS. ROUTLEDGE.

NOTE.—Dr. King has stated in his Reports "*that young Bamboo shoots are too heavy to float*." I may mention that Dr. Ribbenthrop has collected for me this season some thousands of *young shoots* from the jungles, *which have been rafted down to Rangoon* for crushing, (by the rolls sent out by me for Government) preparatory to being transmitted to me here for manufacture into Paper, and "Paper Stock."

The above is the preface to a pamphlet on "Bamboo and its treatment" that Mr. Routledge is now preparing for publication.—ED., *I. A.*

The Indian Agriculturist.

CALCUTTA, MARCH 1, 1879.

COFFEE LEAF DISEASE.

THE death knoll of *Hemileia vastatrix* is, we think, sounding, and this great scourge of the coffee planter has after so many years of unchecked reign, at last been firmly grappled with. We publish elsewhere a paper by Mr. D. Morris, the Assistant Director of the Royal Botanical Garden, Ceylon, which embodies the most important information that has as yet been obtained on this subject. It was during the course of experiments, carried on at the Wallaha Coffee Estate, in January 1879, that Mr. Morris with the aid of the microscope traced the fungus definitely to its first stage of existence on the coffee tree. It was generally surmised, that the fungus must be present in the growing tissues of the coffee plant in a *diffused* form, and thus produce the stains that have been observed on the bark of young stems, but it had, until now, only been detected in a definitely organised form in the cellular tissue of the coffee leaf, and it was reserved

for Mr. Morris to show how it got there. It had been shown, by experiments made a year or two ago, that if the mature, orange spores of this fungus are laid upon charcoal, kept continuously moist, they soon germinate. The spores swell up considerably into gelatinous translucent masses, and develop into filaments which grow very rapidly and become more or less branched. Under such, so to speak, artificial growth, there are no orange spores formed, but at the termination of some of the branches secondary spores are produced, in the shape of radiating, necklace-shaped, strings of small spherical bodies of uniform size, closely resembling the fructification of *Aspergallus*. At the time of the year, Mr. Morris' experiments at Wallaha Estate took place, the existence of the fungus on the coffee plant is not apparent to the naked eye, and it has been generally supposed that the spores remain dormant from, say December to March. This theory has been definitely disposed of by Mr. Morris' investigations. He found and detected by the aid of the microscope, the fine filamentous threads of *Hemeleia vastatrix* covering the stem and branches of the coffee plant, and, as their growth is very rapid, covering them, as well as the leaves, with a fine network of branching mycelium. Mr. Morris finds that at this its *first stage* of existence, the fungus has no injurious effect upon the tree, and he is undoubtedly correct in stating that such nourishment as it requires at this, filamentous stage is evidently drawn from the moist shaded atmosphere in which it grows. These filaments are so minute that they cannot be detected by the naked eye, and their extreme fineness is more vividly brought before the mind by Mr. Morris' statement, that it takes nearly 40,000 to make up an inch diameter. The fungus commences its work of destruction, when the filaments reach the leaves. The upperside of the leaf, covered with a parchment-like skin, is impermeable or nearly so, and the filaments are unable to penetrate it to any extent, but the lower side of the leaf, containing the *stomata* or open pores, through which the plant absorbs carbonic acid and exhales oxygen, offers no resistance to the entrance of the filaments, more especially during wet weather, when the stomata are wide open. Once the filaments enter the *stomata*, they branch and ramify among the intercelluary tissues of the leaf in all directions and begin to feed upon the juice of the cells. Thus the fungus begins the *second stage* of its existence.

Under the stimulating influence of the nourishment, it thus draws from the juice of the leaf, the fungus soon looses its filamentary character. The filaments instead of being long and slender and moderately branched, as they appear on the stem, branches, and on the *outside* of the leaves, assume, once they begin to feed upon the intercelluary tissue of the leaf, a thicker, more branched and coral-like appearance. The terminations of each branch may be seen in contact and often penetrating the walls of the cells, and gradually the cell contents are absorbed and taken up by the parasitic fungus.

The presence of the fungus, or rather its action becomes then apparent to the naked eye, for if the leaves are held up to the light, a number of semi-transparent dots are observed here and there, revealing the centres of attack. The fungus gradually spreads throughout the tissues of the leaves and disables them to perform the important alimentary and digestive functions, nature has assigned to them. The fungus now reaches maturity and, with this its *third and last stage of existence*. The filaments again push to the outside of the leaf and develop, each thread, a single sub-reniform, orange-coloured spore, attached obliquely to the base. These spores are innumerable and the lower side of the leaf appears, consequently, covered with an orange-coloured powder; a great many of these spores fall off, when mature, and may get blown about if there is a strong wind, but the greater number of them remain on the leaves until they are shed. The heavy, oily character of these spores, inclines Mr. Morris to believe that they are not carried far from beyond the tree on which they developed, and he refers to the *secondary spores* as the chief source and danger of disseminating the fungus over wide and distant areas. The development of the *secondary spores*, to which we have above referred, instead of that of the mature orange spores, seems to depend upon certain circumstances the chief of which probable is the want of proper food (*i.e.* the juice of the *living* leaf). Mr. Morris, therefore, and we think rightly, surmised that leaves which are covered with the filaments of the fungus, and which drop off before the fungus reaches its third stage of existence, are a source of greater danger as infection carriers, by developing an innumerable quantity of *secondary spores*, than the primary orange-colored spores. The secondary spores are so minute, and of such light construction, that they are easily carried away by the wind; and as this dropping off of leaves, before the development of the orange-coloured spores, is especially notable in abandoned estates and on coffee trees cultivated by natives, it will be necessary, if Mr. Morris' surmise is borne out, to adopt legislative measures to remove what would always remain a fertile source of continually supplying secondary spores and of infecting estates, that by measures, now in course of adoption, may succeed in getting rid of this direst of enemies to the Coffee Industry.

Mr. Morris passes on, to consider the remedies that can be adopted for stamping out the disease. Sulphur and lime, jointly or separately, are the chief substances that appear adapted for the purpose. Sulphur has before now been suggested as a possible remedy, by several scientists in Europe, but with great diffidence and hesitation, as only the dry leaves had formed the basis of their investigations and they had not been able to detect the filaments *externally*.

The discovery that the fungus in its first stage of existence is entirely external and that it, so to say, climbs up the stem and branches in search of the leaves, is important, and introduces an entirely new phase of the subject. It is, of course, at once apparent that the only chance of destroying the fungus exists during the first and *external* stage of its existence. As said before, it can *then* not be detected by the naked eye, and it is necessary therefore to treat all parts of a coffee estate alike, if it is resolved to battle the enemy.

There are a great number of substances that will destroy fungoid parasites on plant life, but not all are adapted for practical use and it would be futile to discuss their respective merits. The only remedy used extensively against fungoid parasites is sulphur, and it has been proved to be very efficacious. It is largely used in Kent as a remedy against mould on hops, occasioned by the fungus *Spaerotheca castagnei*, allied to the fungus that causes the vine-disease known commonly as oidium. This fungus was formerly one of the greatest plagues of the hop-cultivators and caused, especially in moist years, heavy losses to the growers; but since the universal application of sulphur this disease has been checked to a great extent.

The sulphur is usually applied before the hops are in "burr" or bloom, with a machine called a sulphurator, drawn by a horse between the rows of plants, an illustration of which appears in No. XXVIII of the *Journal of the Royal Agricultural Society of England*, from which number this description is taken. Two separate applications of sulphur are usually made; the first when the "bine," as the shoots are called, is just over the poles, the second just before the "burr" or bloom appears About 50lbs. per acre is put on at each application, at a cost of about 15*s*. per acre, each time. The sulphurator may be described as a wheelbarrow that when wheeled along turns, by a second smaller wheel attached to the axle, a fan that blows the "flowers of sulphur" with which it is fed, evenly and minutely

between the plant. The sulphur settles and covers as fine powder, stem, branches and leaves of the hop-plant, and covers as well the ground, and destroys by its chemical action the fungoid parasite.

Mr. Morris has ascertained, by the experiments carried on at Wallaha, that when sulphur comes in contact with the filaments and spores of *Hemeleia*, it completely destroys their vitality. This with the experience gained by the Kentish hop-planters, ought to be sufficient inducement to the Coffee Industry of Southern-India and Ceylon to take the matter in hand in right good earnest.

The sulphur must, of course, be applied when the fungus is in its first stage of existence, invisible then to the naked eye. December to March, is given by Mr. Morris as the period during which this stage lasts in Ceylon, and he recommends the mornings and evenings when the dew is on the leaves, as the most judicious time of giving the coffee plant its dose of sulphur; and he states that with an abundant supply of dew, the sulphur blowers completely cover the branches and foliage of the trees with a thin uniform coating of sulphur, which remains on them for several days, even after heavy rain. Soon after the sulphur was applied, Mr. Morris noticed the peculiar pungent smell of sulphurous anhydride or sulphurous acid, generally known as the smell of burning brimstone. There can be no doubt that this sulphurous acid, generated by the action of ozone upon the finely divided sulphur, is the agent which destroys the open and soft structure of the fungoid filaments by its great attraction to oxygen, while it is comparatively harmless to the firm and close structure of the coffee plant. As during this season the coffee plant flowers, it had been feared that the application of sulphur would check or prevent entirely the "setting" of the blossom, but this fear, we are glad to say, was groundless, as the blossom that was on the Wallaha coffee plants, while they were sulphurated, has set most satisfactorily. As the action of *sulphurous* acid during its formation from sulphur and subsequent conversion into *sulphuric* acid, has properly been recognised as the true agent in destroying the fungus, advocates for *direct* application of sulphurous acid are not wanting. "Why," say these gentlemen, "should we waste such quantities of sulphur when its whole action is due to the sulphurous acid which is formed from perhaps only its hundreth part, will it not be much better and more economical to burn the sulphur among the trees, and let the resulting sulphurous acid act direct upon the fungus ?"

We have strong reason to believe that this view is fallacious, the action of sulphurous acid in its *nascent* state, is very different and far more powerful, then when it reaches the fungus, after it has been formed and has combined with the moisture of the atmospheric air. If the *fumes* of sulphurous acid had the same effect, as the *nascent* sulphurous acid resulting from the spontaneous combustion of the sulphur in actual *contact* with the fungus, the hop cultivators of Kent would have adopted the fumigating process long before this.

We are assured that coffee planters cannot do better than follow the sulphurating process, which has been so effectual in checking the former ravages of *Spaerotheca castagnei.*

A letter in the *Ceylon Times*, by a young medical man, Mr. W. G. Wait, warns against the injurious effect of sulphurous acid gas upon plant life. Though, as said above, we do not believe that sulphurous acid *fumes* will be found as efficaceous as sulphur itself, those who are determined to try it, need not be deterred by this false note of warning. Mr. Wait is quite correct in saying that sulphurous acid will seriously injure plant life when inhaled, and the results he gives of placing plants under glass shades, in a confined atmosphere in which sulphurous acid is diffused, are quite in accordance with our knowledge of the action of this gas, but it has escaped Mr. Wait that, under the circumstances he relates, the plant is inhaling the same volume of air over and over again, there being no movement in the air around it, and the want of carbonic acid has probably as much to do with the withering of the plant as the sulphurous acid. Coffee plants in the open, with a continually changing atmosphere around them, will not be affected to the extent, Mr. Wait fears. As a fact, we have seen trees and plants in the immediate vicinity of the sulphur furnaces of a chemical work, flourishing in health and vigour for years; though, night and day, the presence of sulphurous acid gas in the surrounding atmosphere could be detected by its smell.

The use of lime as an alternative or an adjunct means of destroying the fungus is also noticed by Mr. Morris, and, while strongly advocating its use when the diseased leaves have fallen off, and the ground is covered with the orange-spores he deprecates, and we think with some good reason, its use to destroy the fungus in its first stage of existence.

But we would draw prominent attention to what is not generally known, *viz*:—that the presence of caustic lime increases manifold the action of ozone upon sulphur, by its powerful affiuity to the resulting product, sulphuric acid. A small quantity of sulphur mixed with caustic lime will therefore be equally, if not more, efficacious than a much larger quantity of sulphur, used by itself. We would therefore recommend to use in the sulphur blowers, sulphur and caustic lime mixed in equal proportion. The lime should be the best procurable, it should be newly burnt, freshly slaked and finely sifted. A general application of lime by itself, Mr. Morris recommends as a destructive agency in the third stage, when the trees and ground are strewn with the orange-coloured sporangia, and it should be plentifully distributed over the stem and branches of trees, and especially over the withered leaves lying on the ground. The benefit derived from the application of lime will be twofold, its manurial properties being well-known.

That the enormous quantity of bulky, organic manures, that has been used in most estates, has facilitated greatly the development and fruitful propagation of *Hemeleia*, by affording a genial germinating nidus for its spores, is undoubted. We warned, last year, against the exclusive use of oil-cakes, fresh cattle-manure and other similar organic nitrogenous matter in *permanent* plantations, such as coffee and tea, and pointed out what a fertile ground the presence in the soil of a large quantity of organic matter, in a *state of decomposition*, offers to the breeding and development of vegetable and animal parasites. We are glad to see that the *Ceylon Observer* is coming round to our way of thinking.

Mr. Morris' paper is certainly not only the most interesting that has as yet been published on the subject, but it is the most important, as it reveals to us the stage of existence during which we can effectually battle *Coffee Leaf Disease.* The happy result of Mr. Morris' investigations should encourage tea planters to take some action regarding its special enemies—Mosquito-blight and Red Spider.

SOILS—THEIR ORIGIN AND DIFFERENCE.

In travelling through any country which presents diversities of lake and river, mountain and valley, plain and down, any one who has any interest in agriculture, cannot fail to notice the differences which the soils of different districts invariably present. On the margin of some rivers and on the shores of many lakes you have the rich alluvial soil, black with decaying organic matter, which under proper treatment is sure to yield profitable returns. Then there is the hungry, dry, sandy soil that drinks in everything, and seems to retain nothing. Again we have clay, pure and simple, which requires special treatment at the hand of the agriculturist. We have calcareous soils, loamy soils, marly soils, peaty soils, garden soils &c., each requiring a treatment more or less special.

Two questions present themselves :—

(1st.) What is the cause of these differences of soils ?

(2nd.) What is the origin of soils ?

The answer to the first question is implied in the second. If we dig through the soil, we come on what is called the subsoil, this frequently, though not necessarily, has some considerable likeness to the soil proper. It might be desirable to restrict the term soil to that portion of the earthy covering which is stirred by the implements used in agriculture, although, of course, the roots of the crop grown, may reach much deeper. If we accept this definition, then, that which lies immediately beneath the lowest portion disturbed by tillage operations would be subsoil. This subsoil may differ in no respect from the soil proper which lies above it; or it may be clay, tough, friable or plastic ; gravel more or less coarse or fine ; or simply sand. There may be no subsoil even, and if we dig deep, enough, we will at last come to hard rock, rock which may or may not have some resemblance to the subsoil and soil overlying it. No matter what part of the earth's surface we dig through, we come at last on hard stony rock. This rock, or some part of it, is the source of all our soils and subsoils. More correctly speaking, the whole mineral constitutents of soils are derived from the disintegration of the rocks which form the earth's crust. This can be easily shown. If a spade full of soil be washed with water, and the water poured off as long as it continues muddy, the mud kept, and allowed to settle, then burned to get quit of all organic matters, the residue from the washing also burned, then what we have left are a few simple minerals, it may be chiefly quartz, mica, felspar, hornblende, some compounds of lime, alumina, oxides of iron, &c. Now if we take a piece of underlying rock or rather if we analyze the rocks that are found coming to the surface at different parts of the earth, (notably the primitive rocks, from which all others have been formed in the geologic past) we will find, though the number of distinct minerals known to mineralogist is very large, yet the rock-forming minerals are very few—quartz, felspar, mica, compounds of lime, &c., being the most abundant. In fact the very minerals we found in the soil, are here stored up in compact masses all over the Globe It does not necessarily follow however, that the soil is identical in mineral composition with the rock immediately underlying it. This may be so, in some cases ; but in others there may be no or little resemblance in composition. Various agencies may have been at work, glaciers, ice-bergs, ice-floes, change in elevation of surface, rivers, &c., to transport soil-material from distances that at first sight might seem incredible.

The agents, that have broken up, ground down, and scattered the mingled constituents of the rocky crust of the earth, over the world may be classed under three kinds, 1st atmospheric, 2nd aqueous, 3rd organic. It should be borne in mind that each of these agencies exercises a chemical, as well as a mechanical effect.

It is one of the objects of Geology to unfold in detail the various changes that have taken place in the earth's crust in the remote pre-historic past. At present it may be sufficient to say that in Britain, the Continent of Europe and America where these changes have been longer studied, and by a greater number of observers than in any other part of the world, the changes in the elevation of land have been considerable, that a climate of Arctic severity preceded the present, that this again was preceded by a climate and a vegetation almost if not quite tropical. At a still earlier period those lands, then in the course of formation lay under a vast and deep ocean, still earlier it was covered with great forests, interspersed with wide marshy plains over which the great sea again and again asserted its sway. There was a time in the far away past of which Geology alone can tell us anything, when no soil covered the hard rocks, when an encircling restless sea dashed itself to foam and spray against their surface ; and when the electric trump of innumerable volcanoes pealed the prelude to frequent and gigantic upheavals and eruptions. Then came at intervals pauses of rest, broken only by the roar of stormy tumultuous seas, rain dashed in deluges on rock and ocean, and the rush of many waters leaping to their level. No sound of human voice was there, no song of bird nor cry of beast, nor any hum of insect filled the hot sulphurous air, nor did any plant, however humble, lift its head and shed its perfume o'er a world, barren, lifeless, chaotic. As time rolls on, the sweep of tide and currents, and the dashing of the waves have broken in pieces the rocks that fringe the shore. The fragments have been dashed together and splintered, and rolled, and ground down ; and carried whithersoever the swelling waters circulate. The larger fragments lie near the shore, the smaller further out at sea ; and away far out in depths, unfathomable fine particles of mud strew the bottom of a vast central sea to which no ray of light ever penetrates. Pile after pile is added, the mighty weight of water pressing all down, and the internal heat of the earth crystalizing and solidifying, till again in the lapse of ages they assume a solid form ; and it may be are again upheaved to perform the same round.

Then again, far away inland, rain and vapour carried by the atmosphere and deposited on the hard rocks, find their way into innumerable chinks and crannies (produced by the same agents) carrying with them gases of different kinds, oxygen, carbonic acid, &c., and compounds of nitrogen produced by the electric decomposition of the air. These acting on the mineral constituents of the hard rocks formed oxides, carbonates, nitrates and compounds innumerable ; and so eating away the rocks, which are further broken to pieces and disintegrated by every frost, for water in the act of freezing expands in bulk about one-twelfth and thus tears in fragments the hardest minerals, with a force, which nothing material can resist. Rains wash the fragments down to lower levels, rivulets of water, streams, brooks and torrents carry them, still grinding them smaller, and corroding, rounding and crumbling them, till portions are carried down to rivers, and borne on, till where they join the sea and the strength of the river's current is lost, and the particles of matter carried with its tide settle to the bottom, the larger near its mouth to form deltas, the smaller further out to form banks and shoals. Where however a current of the sea sweeps past the mouth of a river, no delta can be formed. The particles are caught up by the stronger sea current and carried to where its force is insufficient to hold them in suspension. Along the banks of rivers they at their mouths, and in lakes and seas into which they flow, we find all the minerals, all the materials organic and mineral which now compose our soils. The power that these agencies have, in changing the whole physical aspect of the world can only be realized by being studied. The examples that occur to us at the moment are the Coast of Spain, the Table Mountain of the Cape of Good Hope, and the Ghauts of India. In these instances whole masses of table land have been carried away, and left hills and ridges to mark the original level of the land.

To determine, when or how organic life first began to play its part on our globe is no part of our purpose at present. It is outside our present object to endeavour to determine what were the beginnings of life, and along what line development proceeded. It is sufficient for our present purpose, that life did appear, and began to exercise its influence amongst the other forces already enumerated, in the formation of soils. We know how a barren coral reef becomes a fertile islet, and if we postulate life, the same causes must have operated in the remote indefinite past of our earth's history. The chemical action of the atmospheric gases, and the operations of rain and sea water, mechanical as well as chemical, break up the rock and cover it with a mineral powder more or less fine, which may be swept into hollows and behind projecting points on the rock's surface. The fine impalpable dust shot out into the air from volcanoes settles down on its moist surface. Fine atoms of organic and inorganic matter revealed only by the electric light are borne on every breeze even to mid ocean ; and washed down by the rain and watery vapour of the atmosphere into the plastic mineral compound, which the other agencies have broken up ready to receive it. Vegetable forms of the lowest kinds are developed on its surface, and decay, thus preparing the way for higher forms of vegetable life. The sea water left by high tides and storms in shallow pools is evaporated by the sun's rays, and leaves its deposits of various kinds, iodides, bromides, chlorides, carbonates, &c., which are again transported by rain and vapour and air, and mingled with the forming soil. Seeds of various kinds are borne by ocean currents to the shores of our islet and cast up on its beach, some of them to strike root, many of them to decay ; and add by the gases and compounds liberated in their decomposition additional material (*See Darwin's Journal of a Naturalist, page 454 et seq*). Here the wandering sea bird rests its weary wing, or it may be makes its home ; and migratory birds of various kinds buffetted by wind

and storm gather strength for further flights, or it may be droop and die, and leave their bodies as a legacy of fresh organic matter to the swiftly growing soil. The great sea throws up its spoil with every wave, molusks that have been crushed in its remorseless jaws. The carcases of creatures that haunt its depths and shallows, are tossed up in its wild woods, and left to swelter and rot and supply the elements of new life.

Year by year the soil deepens and becomes richer, vegetation of a higher kind covers it, this in turn gives way to others, each increasing the accumulated stores of the other ; and so the varied processes of death and life, renewal and decay go on, till trees of statelist kind clothe the surface ; and fruit and flower and insect, and bird and beast, each in their varied order possess it, and clothe our barren rock with life and beauty. Last of all comes man, the Lord of this fair world.

This, very hastily and imperfectly sketched, is an outline of some of the mechanical and chemical agencies and processes which have formed soils. Other agencies, however, have played their part as well in the same great total. Far out at sea, in depths dark and still, to which never reaches the faintest hum of warring wind and water in the fiercest hurricane, creatures, down in the deepest depths, live and move and have their being. Curious and wonderful are they in structure, insignificantly little, but like the coral insect, that builds miles and miles of fringing barrier reef and compasses a continent, these creatures (*Foraminiferæ*) live and die, and in their decay are adding little by little, atom by atom a new deposit to the earth's crust. Creatures of a similar kind in a former age of the world formed all our chalk cliffs and cretaceous deposits. The microscope reveals the identity of the ooze of the Atlantic and the chalk deposits of the tertiary formation.

THE DISTRESS IN THE N.-W. P.

THE effects of a year of drought and famine do not end with the breaking up of the last relief-work, or closing of the last poor-house. In the North-Western Provinces, the residuum of starving pauperism shows no inclination, in these bitter winter nights to leave the shelter of the Government sheds. But even when the last dregs have been drained off, there will still remain, unfortunately, very plain and evident marks of the past time of affliction, to those whose eyes are open, and who have time to think over what they see. One unmistakable and mournful symptom, is the number of suits for arrears of rent. The landlords, as a rule, did not do badly by their tenants while the pressure lasted. There were exceptions, and these too, often of the most inexcusable kind, where wealthy landowners refused, until urged by the district officer, to assist their helpless tenants with food and seed grain. In striking contrast with these were the numerous instances of small resident landlords, themselves too commonly in circumstances of great embarrassment, who manfully stood by their tenantry to the full extent of their means, keeping, the village in comparative safety through the worst days of dearth, On the whole, we are glad to record that the proprietors of land were just and generous to the cultivators during the harvest year from June 1877 to June 1878, which may roughly be taken as comprising the days of sharpest distress. When the year ended and matters began to mend, the landlords set themselves to recover as much as they could of what they had advanced to their tenants. Seed and food they could not sue for in the revenue courts ; but arrears of rent are recoverable by process of law ; and it makes no difference, from a purely legal point of view, whether the harvests of the year have been a failure or a success. The cultivator, in nine cases out of ten, has been unable to pay. He has absolutely nothing to satisfy the arrears due on account of the lost autumn crop of 1877. His spring crop of 1878 was an unusually good one ; and there have been no complaints about the autumn crop lately harvested ; but each of these had to pay its own rent, together with the not inconsiderable addition due for the landlord's advances. Thus there is no means of making good the missing rent ; and the revenue courts have no option but to grant decrees against the cultivators, reserving only, as the extreme limit of mercy, the right to throw the costs of the suit upon the landlord.

Having got his decree, the landlord can execute it by putting his tenant in the civil jail, or by selling him up. Neither process is worth the attendant expense. Imprisonment of a pauper is a profitless amusement ; and the law forbids the sale of the only property which the tenant possesses, namely, his plough and bullocks. In truth, it is for other reasons that these decrees are sought. A decree for arrears of rent is valuable in the landlord's eyes because it breaks the tenant's right to occupancy of his land. In the technical language of the law, it converts him from an occupancy tenant to a tenant-at-will, with this difference only, that he can regain his occupancy rights by paying up his arrears within a certain time from receipt of notice. As payment, however, is out of the question, this privilege is not one of any great account. Occupancy rights, as everybody knows, are acquired by the unbroken possession of a cultivating interest in land, not dependent upon a lease, for a period of not less than twelve years ; and a tenant who has acquired this right, is thereby protected against ejectment, so long as he pays his rent and does nothing to prejudice the owner's right and interests in the soil. Indian landlords are perhaps not much more short-sighted, in the matter of tenant right, than landlords everywhere else. Irish tenants have for years been fighting for 'fixity of tenure,' with very partial success. But it is in India, where the tenant is incomparably more helpless than in Ireland, that the hardship of inelastic land laws is most strikingly seen. It would, indeed, be unfair to blame the laws, or the framers of them, as if they had neglected to protect the weaker side. On the contrary, the Rent Act of 1873 was drafted by a Committee of officers, inferior to no man in the province as regards knowledge of the circumstances of the cultivator, and actuated by the sincerest sympathy with him, and the strongest desire to protect him by all means in their power. Nobody can read the Act without seeing that it makes signal and beneficent provision for maintaining the tenant in all his vested rights. It might be dangerous to go farther, and to tell the landlord that it must depend, in the ultimate resort, upon the discretion of the revenue court, whether he shall or shall not be allowed to enforce the processes granted him by the letter of the law. And yet, if revenue officers had leisure and opportunity to make themselves acquainted with the state of the agricultural population in possession of occupancy rights, such a discretionary power would in all probability be exercised to the real good of both parties. It is sometimes possible to bring the parties to a compromise, by summoning them before the court, and giving them good advice from the judicial chair ; or the subordinate revenue officer may be instructed to do this and report the result. When every expedient has been tried, it still remains too often the case that the landlord insists upon ejecting the tenant, and succeeds in obtaining his desire. But it were useless to blink the fact that in a large proportion, if not, indeed, in the majority of instances, no mitigatory expedients are tried at all, and the order for ejectment is given as a matter of course, upon proof of an unsatisfied decree for rent. This is only one of many examples of the silent and unnoticed operation of our laws in changing the economical condition of the mass of the people. The failure of a single harvest may thus be followed by the wholesale annihilation of rights which have been growing up, under the special protection of the legislature, for half a generation previously : and the chances are that the inconsistency between principle and practice will escape unobserved. The district courts have neither time nor method to notice it ; and the central revenue authorities lose the vital fact in a crowd of annual figures. The fact, nevertheless, remains that one consequence of the past famine has been the loss of the tenant-right enjoyed by a large proportion of the cultivators of the North-Western Provinces.

Occasionally this process presents itself in a lamentably startling shape. A widow, for example, will sue to recover possession of her deceased husband's land. He was a cultivator with occupancy rights, holding a number of fields in common with his two brothers. In the midst of the drought, the whole family emigrate to the Terai, and, finding no means of livelihood there, returned home, where the three men died of want, while the women went back to their parents. Meanwhile the land lay idle till the autumn, when it was given into other hands. The spring crop has been reaped, and the new autumn crop sown, when one of the widows comes forward and claims possession. Of course, to dispossess the actual tenant would be out of the question ; but the hardship lies in the fact that even after his interests have been saved, the widow has no right in the land. Perhaps it would be equitable to acknowledge her right to the land, if she could till it, but no such

arrangement could be enforced under the law. The case is only one out of many. Sometimes it is the occupancy tenant himself who returns from exile, and claims restitution. In every case the result is the same; the landlord contests the claim, and defeats it; and one more specimen of tenant right disappears. The victories to be recorded on the other side are few indeed. The truth is that in contending with his landlord, the cultivator is terribly handicapped by the fact that the village accounts, to which the revenue courts naturally look for the best evidence, are kept by a man who is the landlord's humble servant. Much has been done to improve the system of village account-keeping; and nobody would wish to withhold credit from these efforts, which may reasonably be expected to bear valuable fruit in the future; but it is impossible to deny that the village records at present are a very imperfect safeguard of the rights of the peasantry. A crucial instance of this is sometimes afforded by this very matter of tenant-right. At the time of settlement, some ten to fifteen years ago, large numbers of cultivators were recorded as tenants-at-will; they have continued to hold the same lands ever since, and have consequently acquired tenant-right in them; but the village accountants, whether through negligence or design, have gone on recording them as mere tenants-at-will, to the manifest danger of a failure of justice whenever the nature of their tenure shall happen to be called in question. Again, there are special provisions for relief to the tenant and the landlord in the case of destruction of the crops by sudden calamity, such as hail. Rents are remitted and revenue is remitted in proportion. The remission of revenue is dependent upon the remission of rents; but while the former is a matter that can be effected by a single order of the collector, the latter is one which needs constant vigilance to prevent evasion. If the village accountants did their duty, nothing could be simpler. They have merely to deduct the amount of remission from the recorded rental of every tenant entitled to remission, and to let him and his landlord understand that the remainder alone represents the amount of rent which can be collected. If the rents of the ruined harvest, as not unfrequently happens, have wholly or in part been collected while the State machinery of relief has been elaborating its conclusions,—and delay in these circumstances is always inevitable, and not always to be deprecated—the necessary deduction should be made from the rents of next harvest. One would think that if the village account system were good for anything, it should avail for this purpose. And in fact it is quite adequate, if only care be exercised in supervision. But unless this condition be fulfilled, there is a fair chance that relief will never reach the class for whom specially it was intended, that is the cultivators. With such influences in league against them, the tenantry are ill prepared to meet calamities of any kind.

EDITORIAL NOTES.

ENGLAND imports 130,000 tons of esparto grass and similar paper making materials every year. Many new materials from which paper of excellent quality can be made have lately been brought forward at home, as substitutes for esparto grass; but in most cases their greater cost, as compared with any of the materials in general use, has been an obstacle to their adoption. Recent researches in Scotland have shown the common grass of that country to possess valuable properties for the purpose, and the fact suggests the probability that some of the coarse grasses of India, a nuisance from an agricultural point of view, might be found to contain fibrous qualities suited to the manufacture of good paper. Large areas of land, over which reedy grasses grow with provoking pertinacity to diminish the value of the land for arable purposes, might turn out to be worth cultivating. The *Typha augustifolia*, a large kind of tussock grass, known as *raupo* to the New Zealand natives, who use it for thatching their houses, which grows in enormous quantities in the swampy flats near rivers and lakes, may, like its neighbour, the *Phormium tenax*, prove a worthy rival to the esparto grass of Africa. The *Wiwi*, another kind of grass, coarse, wiry, and apparently useless, growing principally in the interior of North Island, New Zealand, should be experimented with for the same purposes. In New South Wales the "grass-cloth plant" (*Boehmeria nivea*) has already received some attention, being used for the manufacture of a fine kind of matting.

THERE is an anxious article in the *North British Agriculturist*, on the prospects of British agriculture. It calls attention to the generally recognised fact, that farming at home has for long been unprosperous, and that its failure has not depended, as usually believed, upon bad seasons. During the past year the weather in Scotland has been favorable, and bumper harvests have resulted; yet the farmers' position has been in no degree strengthened; and it is concluded that if prices of fat cattle do not increase during the spring months, there is bound to be a heavy deficit this year again on the majority of farms; and there is not at present the remotest prospect of any such improvement.

But attention is justly called to the fact, that the landlords throughout England have shown practical sympathy with their distressed tenants, as the following statement of rent reductions will prove :—

Names.	Amount returned.
Mr. H. Savile, Rufford Abbey	15 per cent.
Earl Manvers	10 „
Duke of Newcastle	10 „
Mr. Foljambe, M.P.	10 „
Mr S. B. Bristowe, M.P.	10 „
Earl Cowper	10 „
Hon. E R. Cust	10 „
Mrs. Colton, South Scarle	10 „
Rev G. C Rolfe, Hailey	10 „
Sir J Noeld, Baronet	10 „
Mr. D Pyke, Somerford Magna, whole of half-year's rent	
Mr. M Biddulph, M.P.	10 „
Mr. Osman Ricardo, Ledbury	10 „
Earl Fortescue	10 „
Sir Hugh Cholmondley, M.P.	10 „
Marquis of Hertford	10 „
Mr. Alsopp, of Hindlif	25 „

In the latter case the reduction took the form of orders to the tenantry for bruised cake or decorticated cotton cake.

THE Paris Exhibition was well illustrated with samples of the many varieties of manure sold throughout France, and we are glad to find that a first-rate display was also made by English firms as recognized by the awards given to British exhibitors. Messrs Ohlendorff and Co. and Messrs. E. Packard and Co. carried off gold medals; Gibbs and Co. and the Nitro-Phosphate Co. silver medals for manures. A London periodical gives an illustration of the Exhibition stand of Messrs Ohlendorff and Co., with samples that for thirty-five years have now been employed throughout Europe, America, and the Colonies with universal satisfaction. The total weight of guano exported from the three Chinchas Islands is stated to amount to 8,000,000 tons. The following countries absorb about 500,000 tons yearly :—England, 140,000; France, 100,000; Belgium, 70,000; Germany, 60,000; various European countries take 50,000. The Eastern United States of America, 35,000; West Indies, 15,000, Mauritius, 20,000. The number of testimonials to the value of dissolved Peruvian guano place it beyond controversy, and manufactories at Hamburgh, Antwerp, Emmerich on the Rhine, Rotterdam, and on the banks of the Thames furnish the world with the greatest of fertilizing agents. In the Paris Exhibition, Messrs. Ohlendorff and Co. exhibited in the English section. Pages of description have been written relative to the several chemical operations to which the imported guano is submitted before it becomes the article of commerce which Voelcker in London, Barral in France, and other well-known experts have tested in their laboratories. Wheat, barley, oats, rye, buckwheat, beet-roots, potatoes, tobacco and rape plants, severally welcome this stimulating and fertilizing manure, which is always guaranteed. Chemistry and agriculture are now in partnership all the world over on the best farms. Taken collectively the exhibition of manures at Paris was a very satisfactory one, and formed a very tasteful series in their ranks of glass cases. Notably in all of them the various elements and processes were displayed with fearless confidence. Farmers no longer believe in *quack* artificials, and the exhibitors did well in calling a spade a spade, and in labelling every article. Messrs. Ohlendorff and Co. exhibited a series of samples of raw guano from the various deposits, including

the old Chinchas; also an interesting collection of the raw materials, being specimens of Spanish pyrites and nitrate of soda used in the manufacture of sulphuric acid, with specimens of nitre cake, pyrites dust, the respective refuse of the raw materials. A collection of twenty medals have been awarded at different agricultural exhibitions to the firm, and to which will now be added the gold medal of the present exhibition. From the circulars in different languages distributed at the stand, the visitor may gather the advantages which Messrs. Ohlendorff and Co., claim for their dissolved guano, and which the special jury consider to merit the highest award in the class. As is well known, the raw guano is variable in quality and faulty in condition, owing to lumps and stones; in the dissolved guano these drawbacks are removed, and the dissolved guano is delivered in a fine, dry, powdery condition, with a guarantee of analysis, so that the farmer is sure of getting exactly what he pays for. About twenty years ago Messrs. Ohlendorff and Co. commenced, at Hamburg, the treatment of raw Peruvian guano with sulphuric acid, and the process proved so satisfactory to the farmer after practical experience, and was so thoroughly in accordance with the teachings of science, that the demand for the dissolved Peruvian guano grew rapidly. We are told that Messrs. Ohlendorff and Co., now supplement their dissolved guano with phosphatic manures, which will doubtless sustain the high reputation of the firm.

Chr. D. Van Lennep, Swedish Consul, at Mahazik, near Smyrna, writes as follows in a late issue of the *Times*:—The cultivation of the willow is recommended by one of your correspondents for districts affected with malaria. His statements on the subject being fully borne out by my own experience in the well-known malaria regions about Ephesus, I beg, through your columns, to call thereto the attention of the authorities in Cyprus. Before the *eucalyptus* was ever heard of in Asia Minor, I had seen the bark of the willow used as a febrifuge. I had remarked the easy and inexpensive reproduction of this tree, its quick growth in damp places, its excellent qualities for fuel and for agricultural implements, and its great advantages for strengthening the banks of capricious streams, and had thence taken every opportunity after the winter floods to stick willow cuttings along the banks of streams and in other damp places in my property; also to scatter plane tree seeds in marshy spots. The result has been that, whereas twenty years ago the full-grown trees in this neighbourhood might have been counted, a luxurious growth of willows and plane trees marks my place, fuel is abundant, fever is steadily decreasing the meandering propensities of my streams are checked, my neighbours have to come to me for agricultural implements, and I have not far to go for timber for all rough purposes.

A disease which appeared in British Honduras some years since, and caused much injury to sugarcanes, has re-appeared there this year, and serious results are anticipated. It appears that the disease first shows itself by a white froth above the roots; that on opening up the roots there is the same froth amidst an abundance of moisture in the roots, and this in dry weather and under a tropical sun. Maggots are bred in this froth, which develop into flies. These flies, when moving about the leaves of the cane, exude moisture from their bodies, leaving stains as they progress; and where such is the case the leaves wither. The loss to crops on a previous occasion when this plague appeared was in some instances in excess of 50 per cent. No remedy or preventive from this scourge is known, or so far as we are aware, has been attempted; and if, from the meagre description given, information can be obtained as to any or what steps can be taken on the appearance of the disease, a great boon will be conferred on the sugar planters of British Honduras.

A Cacao planter in Trinidad states that he has trees which yield him 15, and even in very good years 18 lbs. of clean dry cacao, at a gathering. This is a great, but not an incredible yield, since Purdie got an average of 11 lbs. at one gathering from some old and neglected, but re-trimmed and properly cleaned tree in the garden, and Lunan—1814—relying probably on Blume—1672—says the annual produce in Jamaica's cacao period, two centuries ago, was generally estimated at 20 lbs. a tree, and averaged, good and bad seasons together, 1000 lbs. per acre (equal to 8 lbs. a tree, at 18 feet apart—the usual distance there, at that period), although in poor soil, and under bad management, the yield per tree rarely exceeded 8 lbs. a year. Cacao cultivation in Jamaica died out in consequence of the excessive duty then imposed on it at "home," and the wretchedly small consumption of that day, partly owing to that fiscal imposition; and only now is painfully and with effort struggling to regain a place as a regular cultivation. It is very far from being worthy as yet of coming under the title of a staple of the old Colony.

Most crops are more or less exposed to the depredations of insects at some stage of their growth, and the cultivator has to be constantly on the alert to devise some means to entrap them. In nearly all cases the insects are different—that is to say, different insects prey on different plants—and the same trap is not available. For example, the cotton plant is preyed upon by the army worm, the larva of the night-flying moth (Leucania unipuncta), and the cotton worm, the larva of an olive-brown moth called Aletia argyllacea. From the well-known nocturnal habit of these moths, and the certainty of their being destroyed by a light, a cheap and effective mode of destroying them has been adopted in America. It consists of pans of viscid matter placed upon posts at suitable distances in the cotton fields. A block of wood is placed in the centre of the pan, upon which is seated a lighted glass lantern. The moths, being attracted by the light, dash against the lantern and fall into the pan, and are thus destroyed before depositing their eggs upon the tender leaves of the growing plant. The army worm is arrested in its migrations by ploughing a deep furrow around the field, and making it smooth by drawing a smooth log of wood along the furrow. The worms fall into this, and are unable to ascend the sides. A safe and novel method of killing the worms has recently been invented. It consists of a sheet-iron furnace, having the form of a half cylinder, tapered at the ends, in which a fire is kindled, and this heated furnace being drawn along the furrow destroys the worms. Previous to this invention it was customary to strew dry straw along the furrow and set fire to it, but this was often attended with danger.

The Famine Commission has been making enquiries for itself, we hear, in the Central Provinces, but our officers are so unaccustomed to such enquiries, while the subject itself is surrounded by so many pitfalls in India, that it will not do for them to trust very implicitly to the answers they may receive. The results of certain enquires so made in one district in the Central Provinces, are now before us. The enquires are said to have elicited the following facts, concerning an area of 1,458 acres, occupied by 33 families, consisting of 179 adults and 90 children. The block, for such we presume, it was. seems to have comprised four villages of 277 acres, 441,413, and 324 acres respectively,

Acres		*Cultivated by*		*Adults*		*Children*		*Total.*
277	..	9 families	...	43	...	19	—	62
441	...	9 ,,	...	56	...	29	—	85
413	...	8 ,,	...	56	...	32	—	88
324	...	7 ,,	...	24	...	10	—	34
1,458	...	33	...	179	...	90		269

Thus each family seems to have averaged 8 persons, while the proportion of adults to children is as 6 to 3, very different proportion from what prevails in temperate climates, where children remain children up to 16 or 17 years of age. Again, the average holding of each family is returned at 44 acres—1,458÷33 families = 44 acres—Are we to understand that this is the average size of the holdings, in the district? If we are, the fact shews how radically different is the economic condition of the Central provinces, not only from that of Bengal only, but of nearly all India.

Mr. Juland Danvers, Government director of the Indian railways, observes that it would hardly have been thought possible twenty years ago that a granary for England would have been found in the valleys of the Ganges, Jumna, and Indus. But we have seen during the last four years an increasing production of grain in the provinces watered by those rivers, and a large export trade springing up. In 1871 the export of wheat was 248,522 cwts.; in 1876 it was 5,583,336 cwts., which was sent chiefly to England. Mr. Danvers says:—"When the fibres of Russia were denied to

us during the Crimean war, India stepped in and supplied us with jute, and has continued to do so to an increasing extent ever since. The same may now happen with respect to wheat, barley, &c. A country with a soil and climate capable of producing corn, tea, and tobacco, as well as coffee, opium, sugar, indigo, and cotton, must possess powers which, with the assistance of regular and cheap transport, will be ready to meet any demand that may be made upon it." With Home charges of £16,000,000 sterling a year to meet, and with England the great consumer of the surplus harvests of the world, India is the most legitimate field to which she can look for her supplies.

We quote the *Indian Daily News*:—

"The experiments of the Government in view to agricultural reform sometimes have amusing results. In one experimental farm, the superintendent of which was deeply attached to fowls, a fine stock was obtained, and taken such care of that the birds died of liver-complaint (in medical language *hepatitis*), caused either by excess in eating or in drinking, we are not quite sure which. In another, the superintendent cultivated a quantity of safflower, without knowing anything of the uses to which the flower of the plant is put as a dye. He wanted to try the seed as a food grain. The last brilliant thing, which has come under our notice, is from a farm, called a model farm, in Scinde. From this farm, flourishing accounts have come for some time past of the wonderfully heavy yield of a particular kind of indigenous cotton, to which the farm superintendent seemed to have taken a great fancy. Moved by a spirit of enquiry, and, perhaps, by some other spirit, a manager of another farm got some of the seed of this famous cotton from his brother farmer, and grew it. His report on it is that it is a very prolific, but very inferior variety, —a variety so bad, indeed, that, twelve years ago, the Government spent much time and money in eradicating it from the district of Khandeish, and in preventing agriculturists from growing it. And it is this stuff on which a model farm manager has been spending his time, season after season, for years past. Another of these gentlemen has been experimenting, in order to ascertain whether 'one or a few trees' have any effect in increasing the quantity of rainfall. These things are not jokes; they are written in Government reports, in which one hardly looks for jokes, intended to be such, though one often finds therein things which move to laughter. It has been said that a former Cotton Commissioner once was in doubt whether if seeds were cast into the earth bottom up, the plants would not grow with their branches downwards—standing on their heads, in fact. That story, however, we utterly refuse to believe, and we are convinced it is a base calumny. But, certainly, if one wishes to look for "awful foolishness" of the kind that distinguished the American humourist, when he temporarily edited an agricultural journal, it will be found in the reports of Government agriculturists managing experimental and model farms. Not that they are all alike however: there are managers and managers. One or two of the farm superintendents, employed by the State, do credit to the professional training they received in England, and have proved themselves competent to adapt themselves, and the principles they have learnt to a different climate, and different systems of agricultural practice."

The first object of the new Rent Bill now before the Bengal Council is to provide a summary procedure for the recovery of rents, similar to that by which process on dishonoured Bills of Exchange, is now [illegible]. Whenever a landlord is able to give certain *primâ facie* proof that rent is really due, the Civil Court will compel its payment, under this Bill by summary process.

Leave to defend will be given only on the defendant's paying into Court the sum demanded, or on his satisfying the Court that he has a defence, and on such terms as to security, framing, and recording of issues or otherwise, as to the Court may seem fit. No appeal will lie from the summary decree, unless the ryot deposits its amount with costs, though the Court may, under special circumstances, set aside its own decree and go into the merits of the case.

This provision, or something equivalent to it, is absolutely necessary for the protection of the landlord, in the circumstances of these provinces. We compel the landlord by summary process to pay the revenue, and are bound to provide some summary process to enable him to recover his rent from the ryot, who constantly refuses it from mere contumacy. The judges will be our native moonsiffs, concerning whom Mr. Mackenzie generously testifies that for "purity of motive, ability, and hard work, the moon-"siffs of Bengal will bear comparison with any other similar "body of judges in any other country."

But the Bill has another and more important object, namely to secure something like tenant-right to the occupancy ryot. The dispute has practically reduced itself to the simple question: Shall the ryot be allowed to sell his right of occupancy? And the Bill proposes to answer it by saying, "Yes: but an actual cultivator of the land only." We are disposed to approve of the compromise thoroughly. It is the fruit we may fairly presume, of a suggestion made some years ago by us in the *Indian Economist*, when we wrote—

"It depends upon the State alone, whether we permit the cultivator to clear himself of his liabilities, by selling his partnership in the land to an outsider, who is notoriously unfit to discharge the duties and responsibilities attaching thereto, and who has no claim whatever upon any consideration at our hands. On the contrary he is the legitimate object of our aversion, for the extortion which we know him to have practised upon the cultivator, to his ruin. We will *not* have the usurer as our partner in the land. Neither by custom, nor tradition, nor taste, nor culture, nor by any of the qualities we look for, is he fit to be our partner in the administration of the land. What we want is a *husband* of the land, which the sowcar can never be.

Having ousted the ryot under the cast-iron pressure of our law courts, the sowcar proposes to make him discharge all his duties as of old, while he the sowcar takes the profits. Stated in this shape, we think there will be but one answer to the demand. The sowcar shall *not* be allowed to enter the State firm as partner in the room of the cultivator whom he has ruined by his extortion, and whose partnership rights he claims to have bought. He cannot buy those partnership rights without our consent, and that we refuse to give"

So the ryot is to be allowed to sell his holding, but, says Mr. Mackenzie:—

We hold that it is only the ryot who actually cultivates his own lands with his own hands, or by means of hired labor, who is entitled to occupancy rights. We have no desire to see the money-lender coming in and taking possession of the land, reducing the actual cultivator to the position of a serf. Nor do we wish to see the cultivator following the example of the zemindar, and converting himself into an idler by sub-letting his holding to a rack-rented cottier. We believe that an infinity of mischief is being done by the encouragement given to subletting owing to the construction put by the Civil Courts upon the law as it stands. It is bad enough to have between the zemindar and the cultivator putnidars, durputnidars, seputnidars, howladars, and so on, to the tenth degree, without allowing the original cultivator to begin the process over again on his own account. We propose to recognise no sub-letting and no sub-division of a cultivator's holding without the consent of the zemindar or other rent-receiver. And if the latter consents to subletting by his occupancy ryot, he must accept the latter as a middleman, and the actual cultivator under that middleman will begin to acquire prescriptive occupancy rights.

The Bill evidences an honest freedom from bias, that promises well for its success. All this part of the Bill as to sub-letting, will require careful consideration, and these sections are to be regarded as tentative only.

Last year's report of the Model Farm at Nagpore is not so satisfactory as we could have hoped. The monsoon rain-fall was unusually heavy and it was almost impossible therefore to weed the young crops. The cotton crop it is estimated will not exceed a six anna one, and the jowari a twelve anna one, at the most. But perhaps the most important para. of the report is the last one:—

"There is no doubt that the farm is capable of great improvement. The site was originally selected because it was near Nagpore and near the Ambajhari tank from which water for irrigation, it was thought, would be obtainable. Water is now obtainable, if in smaller quantity than it was at first expected, still in sufficient quantity for small experiments. But the site was not chosen

because of the goodness of the land. On the contrary the soil is for the most part very poor, the fields were far from level, and though much has been done to improve them and the land is very much more valuable than it used to be, still very much remains to be done, and that can only be done gradually as a large grant of money cannot be made available.

We notice from the last report of the Board of Revenue, Madras, that the area of land under indigo cultivation in that Presidency has increased during the past year to the extent of nearly 50 per cent. In the official year 1877-8 the extent of land assessed was 92,000 acres, while in the year 1878-9 the assessment was upon 143,000. The assessment increased proportionately from 2 to 3 lakhs. These facts are worthy of notice in view of the degree to which indigo cultivation is decreasing in Bengal. The growth of cotton, we observed from the same report, considerably diminished. The area in 1877-8 was 560,000 acres and the assessment 6½ lakhs, the figures diminished in 1878-9 to 520,000 and 6 lakhs.

Concerning the wild olive groves in Burmah to which we alluded in our last issue a Rangoon newspaper repeats the question :—"How is it the Forest Department of this province with its large staff of Europen Deputy and Assistant Conservators have not discovered the existence of these valuable trees long ago? Surely with the expensive European training those gentlemen undergo at the public cost on the Continent of Europe as well as in England, we might predict that no valuable trees would long remain unknown in Burma. We remember some years ago that the castor oil tree which grows wild all over Burma was said in some report to produce a very inferior oil as compared with the Indian species. Nothing as far as we have heard has ever been done to improve it, although judging how easily the wild plant grows anywhere, there could not be much difficulty or expense in introducing the castor oil plant which does give a valuable oil. All the castor oil used in Burma is imported just as it was a dozen years ago. The Forest Department might surely endeavour to extend and improve the cultivation of oil seeds of all kinds. Here they would in doing so be interfering with no 'vested interests' whilst helping to extend our export trade and the cultivation of our millions of acres of waste land.'

There is indefinite room we are persuaded for cultivating the forest produce of this vast Empire. American enterprise has discovered a means of getting yet more work out of "the busy bee." Sets of small boxes are placed in the upper part of the hives, which can be drawn out when filled and fresh boxes inserted, so that the poor insects never arrive at the end of their labours. But the great advantage of the plan is that the comb formed in these drawers, being in small compact pieces, can be sold in its original state by the retail dealer; and it is stated that 100 tons of such comb have just been landed in London from America. The bee business appears to be carried on to an enormous extent in the United States. Boats laden with hives are floated up and down the Mississippi, so as to constantly visit fresh pastures of flowers according to the latitude and the season. On land, apiaries are planted at certain intervals in orchards, and other suitable places, for which accommodation a rent is paid by the bee-master. About 35,000,000lbs. of honey are annually made and sold. In strange contrast to this, an English clergyman recently appealed through the papers for a market for his honey. He had actually had to give it away. Is there no honey trade in India?

The list of trees planted during the past year by the Forest Board of South Australia gives one a favorable idea of the exertions that are being made to render Australasia fertile:—

Tasmanian Gums ...	79,400	Cedar of Lebanon ...	440
Australian Red Gum ...	21,000	Cypress	112
" Blue Gum ...	14,400	Kaffir Thorn	3,000
" Sugar Gum ...	11,370	Maple	6,046
" Jarah	4,800	American Ash	4,200
" Iron-bark ...	3,500	Spanish Chestnut ...	4,493
Pinus insignis	30,000	British Oak	11,680
Halepensis	12,940	" Ash	140
Canadiencis	7,500	" Walnut	1,400
Maritima	2,000	" Willows... ...	1,000
Excelsa	1,678	" Wild Cherry ...	85
Jeffreyii	1,243	Australian Shea Oak ...	2,000
Other species of *Pinus* ...	1,180		

COMMUNICATED AND SELECTED.

AGRICULTURE AND THE PEOPLE IN BUDAON.

Ever since I have been in India, I have given considerable attention to this subject, and have in a small way done my utmost to introduce improvements in the mode of agriculture, staples, seeds, cattle, implements and so forth. So far as my experience goes, it seems hopeless under present conditions to attempt much in the direction of improved modes of agriculture, that is to say in the way of introducing what is termed "high farming." Until capital is directly applied to the cultivation of the land on a large scale, the general level of the agriculture of the country, must remain very much as it is. At the same time, I do not think that the attempt should be abandoned, and I should strongly urge the organisation of a strong well-officered Agricultural Department, whose sole aim would be the general improvement of the agricultural condition of the country. The present Opium Department might at first be utilized for this purpose. As it stands it has a very fairly complete organisation and has dealings with the most industrious classes of the cultivators, and it seems a pity that this organisation should be confined merely to promoting the cultivation of the poppy. With very little trouble its scope might be enlarged so as to include cultivation of all kinds. This Department could extend the present system of giving advances to the cultivators, so as to enable them to produce the more valuable staples on the one hand, and on the other hand, to cultivate the ordinary crops on more liberal principles. Thus the capital which is indispensable to any improvement in the agricultural condition of the country, would be supplied, and a foundation would be laid for further progress.

In the matter of implements very little success has attended my efforts. For the last four years I have carried about with me an English plough and have worked it in the villages almost daily, during the camping season. The people admit the wonderful efficacy of the plough, but the price Rs. 35 to 40, is prohibitive. As a beginning, I should suggest that in each district some twenty or thirty ploughs should be provided by Government, to be let out at small fee to cultivators. I have lent my plough to cultivators on many occasions and they have fully appreciated its value. Again I introduced into Budaon the Beheea sugar mill, but its superiority to the ordinary wooden "kolhu" is so slight, that its adoption does not appear to be probable. In the Terai, however, this mill has proved a great success I believe. Only the other day, however, I introduced a small piece of machinery, of which I have the highest expectations, I refer to Bull's Patent Sand Dredger for sinking wells. The cost of this machine or instrument is Rs. 100, though one of the smaller size can be procured for Rs. 50, I believe. This machine I let out to zemindars and cultivators at a fee of eight annas per diem, and I have had already a sufficient number of applications for it to keep it at work for several months. I have not yet been able to make a detailed experiment regarding the comparative cost of the work done by it and by a native "jham," but I am assured by the manager of the Bilsi indigo factory, who has tried it in a deep well, that the amount of sand excavated is double, while the cost is half what it would be by the ordinary method. If this be correct, the saving of cost in sinking wells by the use of this instrument will be considerable, and ought to be an important factor in connection with the great question of the extension of irrigation by means of masonry wells. I am anxious also to introduce a set of boring tools to be let out at a small fee to persons who wish to sink a well. By preliminary borings, the great risk attending the sinking of a well at haphazard will be avoided, and thus I think a great stimulus will be given to the construction of wells by the zemindars and others. In such small ways a very great deal can be done to help and encourage the people who are marvellously helpless in all matters connected with the introduction of any novelty.

I believe some sort of attempt has been made to introduce improvements in agriculture in the estates under the Court of Wards. Sir John Strachey when Lieut.-Governor, suggested that these estates should be utilized in the way of setting a good example of the results of improved agriculture. I do not think that this suggestion has so far been adopted to any great extent. I should strongly suggest that these estates be

managed and administered by the Agricultural Department. At present the Tehsildar *plus* an unprincipled *sazawal* furnish the management of such estates with results which can be easily imagined by any one conversant with such matters. Were these estates worked properly by the Agricultural Department, they would furnish the very best field for experiments in agriculture. I believe that some such scheme has been proposed by Mr. Buck, Director of Agriculture and Commerce, N.-W. Provinces, and I hope that the suggestion will be favorably entertained.

I am not sure that much can be done in this direction, but I think every effort should be made. The establishment in each district of a seed depôt from which and through which zemindars might obtain improved seed, has been often suggested, and I think the idea is a good one. Such a depôt would involve no cost whatever, as it would be managed by one of the district staff. This officer would indent for the seeds required upon the Director of the Agricultural Department, and thus the Department would be brought into connection with the Districts. At present it has no such connection and its usefulness is in consequence very much curtailed.

Owing to the increase of cultivation, the grazing lands have been much curtailed of late, and in very few districts is there much breeding of cattle. However I think the distribution of good stock will have a good effect in time. There is still some breeding in the Budaon District, and I have indented for 6 bulls to be distributed next season. I have this year distributed 12 half-bred rams which I received from Mr. Buck. The people appreciate them very much, and I hope to be able to report favourably of this experiment. The Stud Department has done wonders for the horses of the country, and I do not see why the same results should not follow from the application of some such system to the improvement of cattle and sheep.

For some six or seven years a very successful Agricultural Show and Exhibition has been held annually at Bulandshahr in the month of March. This Show was instituted by Mr. H. Willock the then collector of the District. To his enterprise and influence the Show is entirely due, and to my mind he deserves the thanks of the Government for having demonstrated by practical experiment how successful and valuable such an exhibition is both in stimulating an interest in agricultural matters, and in bringing the native community together. The Show is not quite so good as in Mr. Willock's time, but owing to the energy of the *tehsildar*, it has been kept up wonderfully well since the departure of Mr. Willock. Till very recently this Show was not officially recognized in any way, and so far owes nothing to the Government, North Provinces. The Show is supported entirely by the contributions of the native gentlemen. The annual income is about Rs. 7,500, which is contributed cheerfully and readily by the native *raises*, who look forward to the *mela* as a Yorkshireman to the Leger. I should like to see such a Show held annually in all Districts, as I am confident that its effect on the native community would have the very best results. I am at this moment trying to organise such a Show in connection with the Kakora Mela in the Budaon District, but owing to the apathy of the authorities, I am afraid I shall have to abandon the project for this year at least.

Land Tenures.

In the Budaon District there are practically only two proprietary tenures, the "zemindari" or undivided, and the "pattidari" or divided. Again the tenures may be divided into simple and complex, or that in which, more or less, one person is the sole owner, and that in which a set of persons holds the estate, either as a united body of co-sharers, or with a more or less complete division of the shares.

As regards the occupancy tenures, the tenant with right of occupancy has in no case any sort of even quasi-proprietary rights, and so far as he is concerned, the question of building a masonry well, does not exist, as no zemindar would consent to such a step, for the building of a masonry well is universally regarded as a mark of proprietary right. The construction of a masonry well for irrigation purposes, is a simple matter in the case of the zemindari tenure, when the owner is a single person or a small set of persons in real union, but when there is a co-parcenary body, with their rights undivided or imperfectly divided or again when the partition though complete is on the "khetbhat" system, as is too often the case, the construction of a well involves many difficulties which will require much discretion and tact to adjust. As pointed out by the President of the Commission, there are almost insuperable difficulties in the way of a compulsory construction of masonry wells. The same difficulties will exist in a modified degree under the alternative or voluntary system, but if the wells are constructed voluntarily it may be naturally expected that the persons benefited will come to some agreement as regards the use, maintenance, &c., of the wells after they have been constructed.

Advances.

As far as I can judge, the only circumstances which stand in the way of the making of wells, &c., is the lack of capital. In another paper I have pointed out that the existing Land Improvement Act is practically inoperative, and that, by a modification of the rules, the capital required might be placed within the reach of the zemindars. My belief is that the zemindars would largely avail themselves of advances for wells and other improvements were advances of capital granted, subject to the payment of moderate interest, which would be calculated so as to repay the capital also within a certain term of years, or better still, as I have suggested in another paper, not repayable, but subject merely to the payment of interest, during the present settlement at a low rate say 6 per cent. Again when the revision of the present settlements takes place the advance of capital would be ignored, and the new assessment would be made in the actual assets. I do not believe for an instant that the payment of interest has the faintest obstructive effect, but I consider that the repayment of the capital, unless it is spread over a very long term of years, has a *prohibitory* effect, and the experience of the Land Improvement Act bears out this view, as no one can be got to take advances under it, because, as I imagine, the capital has to be repaid in large instalments within a stated period. I have made the most earnest and constant enquiries into this subject and I am convinced that with a modification of the *tacavi* rules so as to admit of advances being made at a low rate of interest, but calculated so as to repay the principal after a term of years, or as I prefer, not necessarily repayable, but to be absorbed principal and interest in the settlement, the zemindars will come forward and take advances for the improvement of their estates, and notably for the construction of masonry wells.

The Assessments.

By adopting the latter proposal, the zemindar would be relieved from any apprehension of an enhancement of the revenue in consequence of improvements made by himself. By the system proposed, the zemindar would obtain half of the profit on the capital advanced by the State, without any risk on his part. At present the zemindar has to trust entirely to the tender mercies of the Settlement Officers, regarding whom he is justly diffident. The zemindar is at present not able to assure himself that the Assessing Officer will take into consideration that the improvements in the assets are due to the enterprise of the zemindar, and whatever be the feelings of the zemindar, it is almost impossible for any Settlement Officer, however justly intentioned, to appraise correctly after a term of thirty years how much of the rise in the assets are due to the expenditure of capital by the zemindar, and how much to the unearned increment of the land. It is not to be wondered that the zemindar should be diffident as to the correctness of the view to be taken by the Settlement Officers, Circular Orders of the Board of Revenue notwithstanding.

Remission of Land Revenue.

In the North-West Provinces Rent Act (XVIII of 1873) there is a section under which the suspension or remission of rent and revenue in cases of calamity arising from hail, floods, &c., is authorised. This section is made use of annually in cases of damage by hail storms, but such damage is confined, as a rule, to one or two villages in each District visited by a storm. I believe that the theory on which the assessment is based, is that the profits of the good years should cover the losses of the bad, and judging by the experience of the past season, it is apparently assumed that this margin of profit is sufficient to admit of regular payment even in cases of extreme drought, when the whole of the most valuable harvest has been utterly lost. Thus during the last six or eight months we have witnessed the rigorous exaction of the land revenue in the face of the total loss of the *kharif* crops, while the occurrence of a hailstorm in one or two villages resulted in a local enquiry by a European Officer, in the preparation of elaborate statements and the suspension or remission of the revenue demand in the

imagined proportion of the damage done to the assets of the estate. This is to my mind straining at a gnat and swallowing a camel with a vengeance.

Further, the exaction of the land revenue in Budaon, and I believe in other districts as well, involved a direct breach of faith with the zemindars which has had the very worst effect on the minds of the native community.

At an early stage of the distress the Collector, at the suggestion of the higher authorities, gave the zemindars to understand that unless they came forward to assist their tenants so as to enable them to tide through the distress and to sow the *rabi* crop, the Government would show them no mercy in the collection of the land revenue for the *kharif*. The zemindars as a rule did their utmost to help their tenants, and an enormous area was sown with the *rabi* crop, but to the amazement of the zemindars, they very soon learned that the orders had come to exact the revenue to the full, if possible, and it was exacted ruthlessly. The people are loud in their complaints of the *be'imani* or faithlessness of the Government, and to my mind, with ample reason.

The collection of the revenue in such a season in any case would have been a harsh and impolitic measure, but under the circumstances it must be stigmatized as a *crime*.

The suspension of a portion of the demand for a few months till the *rabi* harvest had been gathered, would have afforded the greatest relief to all classes of the people and would further have encouraged them to believe that the Government sympathized with them in their trials.

On the general question of the system of revenue collection in vogue in these Provinces, I cannot do better than quote one or two passages from a very able and interesting work, lately published, called "Our Land Revenue Policy in Northern India," by Mr. Connell of the Civil Service. He writes as follows :—

"Starting with a tax, which is in many cases considerably in excess of the 50 per cent., and which in some districts constitutes unmistakeably a rack-revenue, there is too much reason to fear that our system is harsh, rigid and grinding to a degree, that we fix a certain sum as the proper amount of the tax, and that we collect it, turning neither to the right nor to the left with a steady, persistent, merciless strictness, worthy only of a Shylock, and not of civilized Government.

"Our system is simply to collect the tax to the last penny through the agency of the *tehsildars*; as the *kists* or instalments fall due, the latter Officer scatters his notices to pay, *dustaks* broadcast over the sub-division. There are now no jungles to fly to for refuge, and there are auction sales which are upheld by the arm of a resistless Government. The Collector knows little and does less. The land-owners feel that mercy is not to be expected, they pay what they can from the rents, and they mortgage or sell their property privately in order to liquidate any balances, for they fear that a smaller sum will be secured if the sale is an auction one, managed by dishonest Government subordinates.

There is in fact no real revenue administration. The Collector, especially in Oudh and the Punjab, is a tax-gatherer and nothing more. He is a compulsory jack-of-all-trades whose days are spent in inditing countless reports on all miscellaneous matters of great and small importance, upon which the local Government of the day sets, or is forced to set, great store. He has to draw up portentous memos on conservancy, municipalities, drains and self-government, all the morning. His afternoons are occupied with his appellate work, and an odd half hour or so, as leisure permits, is with difficulty snatched for the real work of a Collector, namely the disposal of the revenue reports. Those papers which have to do with the future prosperity or ruin of villages, must be perfunctorily rushed through, while the proposal for a new latrine has taken up hours of valuable time. The English correspondence and judicial work must be got through for obvious reasons, but few know or care about the internal state of a district so long as the revenue balance sheet is clear. The register of transfers of landed property may be long enough to stretch from Lahore to Peshawar, but few pay any attention to a trifle of this kind. The revenue has all been realised without much resort to coercive measures, for the mere threat of a *tehsildar* suffices in most cases to drive the land-owner to the money-lender; and the local Government congratulates itself that the largest revenue ever known has been realized in a year of agricultural distress without any noticeable resort to the sterner coercive processes. Those who go among the people, and who really make good use of their cold weather tour, know how grinding is the poverty of the land-owners, who have been forced to borrow at ruinous interest, to mortgage, and to sell, in order to meet the relentless Government demand. So the years roll on, and then perhaps, when half the land in the district has changed hands, the Government wakes up, and the reason is asked in surprise. A culprit is sought, but who can possibly be charged with the crime, for the head of the district has been changed every year, and each officer has governed on the old principle of "after me the deluge."

"It is considered that as a general rule, a good season and a bad season should be held to counterbalance one another. The Government takes no more in a year of abundance than it does in an ordinary year, and therefore the landlord is expected to be able to pay up in full in years of bad harvest. Even supposing this is quite fair as a general principle, in practice it is quite unsuited to the character of the people. They have yet to learn what is meant by prudence and economy, they have no place to keep any surplus receipts, they have rarely, as it is, much to spare, but what they have is at once expended on a long-deferred marriage, in payment of sums due to the money-lender, in buying new clothes or a few trinkets for their families. With men of improvident habits it is absolutely necessary to take what we want from a man at a time when he has the money. It is useless to expect payment at a later period, unless we compel him to resort to the money-lender. Our system, is founded on a direct refusal to consider the habits and character of native land-owners. We fix a demand for thirty years, holding, that what we collect in that period will, on the whole, taking good and bad years together, about represent half of the total receipts. Our system fails, because it will not consider that it is far easier for a native land-owner to pay double in a year of double receipts, and half the required sum in the following year of agricultural distress, than for him to pay the same sum in each of the two years."

In other words, our system of revenue collection is inelastic and does not adjust itself to the circumstances of the people and, further, is not properly supervised by the European officers. The lack of proper supervision has been much aggravated of late years by the frequency with which Officers are transferred from one District to another.

I have already pointed out the blot in the system which excludes two out of three European Officers from all share in the administration of a District and confines them to purely judicial functions. This defect is especially pernicious in its connection with the revenue administration. For several years the local Government, in its annual review of the revenue administration, has urged on district Officers the advisability of utilizing their European subordinates in the supervision of the Revenue administration, but so far, little has been done in this direction.

Prevention of Famine.

Irrigation Works.

It is somewhat surprising that none of the questions under this head has any reference to irrigation by means of wells. However, the memorandum lately published by the President of the Commission shows that the question has not escaped the attention of the Commission.

I think that it should be adopted as a leading axiom in connection with the prevention of famine, that every portion of British India should be provided with the fullest irrigation which circumstances will permit. Canals, tanks and wells are each of them best suited to some portion of the country as a means of providing the necessary irrigation, and I should strongly advocate the organisation of an Imperial Irrigation Department, whose duty it will be to make a survey of the whole country with special regard to its capabilities for irrigation, whether by canals, tanks or wells, or by any combination of them.

I have, in a separate paper, pointed out how the Rohilcund Division of the North-West Provinces is admirably suited to a system of well irrigation, and have expressed my belief that the people will themselves construct wells on a large scale, if capital be advanced on favorable terms. In any case it seems to me the clear duty of Government to take measures to provide the amplest irrigation possible, and the organisation of a special Irrigation Department will best enable this to be done uniformly and satisfactorily.

POSTSCRIPT.

In connection with the questions of the improvement of the agricultural condition of the country, the best means of bringing capital within the reach of the cultivating classes, should, if possible, be discovered, for without the application of capital, no progress is possible. This question attracted the attention of Sir John Strachey when Lieut.-Governor of these Provinces, and he sanctioned a small experiment in the way of an Agricultural Bank, though why this term was applied to the scheme, I do not quite understand. In any case it aimed at giving money advances to the cultivator on the part of Government, very much in the way that the native *soucar* deals with them, with the exception that the rates of interest were much lower.

The experiment was on a very small scale, and so far nothing has apparently come of it. This is to be regretted as it contained germs of the system, which to my mind yields the only hope of any real improvement in the agricultural condition of the country. As illustrating the ease with which such transactions can be conducted under the existing conditions of our administrative system, I would cite what occurred during the past season in Budaon.

In the months of October and November last, the Collector of Budaon advanced Rs. 37,000 for the purchase of seed to tenants on the security of the zemindars, who were invited to come forward and assisted their tenants in this way, if they could not themselves provide the necessary advances. This sum might easily have been raised to Rs. 1,50,000 but for the timidity of the higher authorities who became alarmed at the magnitude of the operations.

Now every pice of this large sum was punctually repaid after the *rabi* harvest in the months of May and June, without the slightest pressure of difficulty of any kind. The money was advanced free of any charge for interest, and I feel certain that but for this help many hundreds of acres would have remained unsown, and many throughly respectable and deserving cultivators would have in consequence been irretrievably ruined. Thanks to the splendid *rabi* harvest, most of the recipients of these advances have been able to pay them back with ease, and are now very little the worse of the calamity which befell them last year.

The moral effect of these advances was also most encouraging. Whenever the District Officers, in the course of their cold weather tour, visited a village which had received advances, they were greeted with the most effusive expressions of gratitude, which were as satisfactory as they were genuine.

I do not see why advances should not be made in this way every year on large scale. The action of Government would at once have the effect of reducing the rate of interest charged by the ordinary money-lenders or *soucars*, and, again, a great benefit would result from the Government being brought into such close and intimate contact with the agricultural masses. The constitution of a strong Agricultural Department, as I have already proposed, would enable this system of giving advances to the cultivators to be carried out in a thoroughly satisfactory manner, and I regard the organisation of such a department as the first step towards agricultural progress.

T. R. WYER.

KHANDESH GOVERNMENT FARM.

(PROGRESS REPORT FOR THE HALF YEAR ENDING DECEMBER 1878.)

At the date of last report (21st July), twenty inches of rain had fallen, or about two-thirds of what is looked upon as an ample monsoon, only the early crops were then sown and those were full of promise which was not however altogether realized, owing to the subsequent months of almost constant rain which ended on the 20th of October, making up the enormous total of 40·89 inches.

2. During the past rainy season the experiment was continued of observing to what extent, if any, the presence of one or a few trees affect the quantity of the rainfall in their neighbourhood. Two gauges were erected as usual, one in a garden well stocked and surrounded by large trees, the position of the gauge being yet sufficiently open for the purpose of ordinary observation, the other was located on the top of a high barn, surmounting the trees, and was thus thoroughly exposed on all sides. The difference in the readings was throughout insignificant, the total for the year being 39·74 inches or about one inch less than on the ground level.

3. The superabundance of rain affected variously and more or less, each and all of the different crops which make up the *kharif* of the district.

4. Of the two kinds of cotton cultivated here, the Hingunghat or "gowram" was uninjured and yielded, both in light and heavy land, a splendid crop. The American variety (Dharwari) suffered from rot in loamy and other rich lands, but gave good returns on light ground. These remarks apply to the district generally as well as to the fields of the farm.

5. In cases where the cultivator's cotton failed, the ground was cleared and resown with bajri, which generally ripened early enough to admit of its being harvested and the field again cropped with *rabi*, of course the abundance of the monsoon alone rendered such practice feasible, thus what was lost on the early crop will be fully made up on the *late*, and the harvest from first to last will be an abundant one.

6. In the case of the jowari, however, the grain will not turn out so well as might be expected from over watering or manuring, this crop becomes excessively luxuriant and developes an enormous weight of straw with comparatively small ears. Much of the farm jowari was ten to twelve feet high, and the crop of 68 acres makes up four square ricks each 49 feet long 22 feet wide and 16 feet high, being nearly double the bulk of any former year's crop, yet the outturn will not be more acre for acre than it was last year. The kurbi (straw) has fallen wonderfully in price, before the rains it was selling at Rs. 8 per cart load, the same quantity may now be bought for 10 annas; with the fall in the price of fodder, that of live stock has as usual gone up, bullocks have advanced from Rs. 60 to 90 per pair, cows from Rs. 15 to 25, and milch buffaloes from Rs. 50 to 90 and Rs. 100 each.

7. The tilly crop although good on the whole, suffered somewhat for want of weeding, the ground hardly once became sufficiently dry to admit of this being done, that the weeds grew up along with the crop and to some extent choked it.

8. The indigo, was similarly hampered, there was also some difficulty experienced in getting the cakes dried and keeping them clear of maggots. Indigo it may be here explained is nowhere extensively grown in this neighbourhood, and always as a dry crop. The mode of preparation as practiced by the Kunbis is very simple, a piece of ground is beaten hard and smooth on the surface and sprinkled with finely sifted wood ashes, on this the pulpy indigo sediment is dropped from the hand in small patches, these take about a week to dry, during which time they are frequently turned over and thus gather up in the process, a large quantity of ashes; this peculiarity although it does not much affect the *local* value of the indigo so produced yet unspeakably debases it as an article for foreign export, and with the view of determining how far the matter might be rectified, an experiment has been in hand for several years; the paste has been dried in frames and cut into squares, according to the most approved system of Bengal and other parts, but the local merchants have not as yet offered a sufficiently enhanced price to make up for the extra labour, and the loss in the weight of ashes, sometimes as much as 10 per cent. of the whole when dried by the ordinary method.

9. A small field was planted with the new Bamieh cotton, which germinated freely, the plants also grew well, some of them attaining a great height, many of them, however, afterwards died off, and altogether the plantation has so far yielded but sparingly. The plant is certainly far from what it was represented to be, and is probably only a sport, if even so much as that from the ordinary Egyptian cotton. As this experiment was lately separately reported upon, it need not be, further noticed here.

10. Statements showing startling returns of indigenous cotton having from time to time appeared in the reports of the Saleru farm in Sind, it was deemed desirable to give it a trial in this Province, and a quantity of seed was accordingly imported when the crop came up, it turned out to be identical with what is known here as *old waradi*, a remarkably prolific but very inferior variety, formerly grown in Khandesh, but wisely eradicated by order of Government in 1867.

11. A small quantity of Nankin cotton seed was also imported from Sind. None was grown on the farm, but a local cultivator made a plantation of it. It has produced a satisfactory crop, but the cotton is in every respect much inferior to the kinds grown here, all the crop has been bought by the farm to prevent its spreading by any chance into the general crop, which is now perhaps the purest stock of the whole Presidency.

12. The sericulture experiment goes on very satisfactorily, three bunds or crops have been matured since the date of last report, the variety was the *deshi* worm of Bengal. It makes a small cocoon of medium silk but is hardy, and better suits the conditions found in Kandesh, than any of the others which have from time to time been tried. The following are particulars of an experiment as to outturn, just brought to a close.

13. On the 1st of November, 400 seed cocoons were selected, on the 8th, moths emerged, and deposited their eggs the same day, on the 17th the worms hatched, and on the 25th of December the bulk of them spun their cocoons, twenty thousand of which were fit for reeling, they are yielding at the rate of 1lb. clean silk to ten thousand cocoons, which will give 2 lbs. of silk as the crop. After the first fortnight one man on Rs. 7 per month was constantly employed in feeding &c., the quantity of mulberry leaves consumed was one gathering of 1-5th of an acre, the

plantation yields four such pickings of leaves annually and requires four waterings, which cost one rupee each per acre. The feeding-house is 36 feet long, 8 feet wide, and 7 feet high, and accommodates 50 feeding trays in five tiers on a wooden frame, the runs of the trays are broad, with bottoms of bamboo matting, they measure 3 feet 4 by 2 feet 4, and two inches deep, each holds 1,000 worms of the small monthly kinds or 600 of the large annual stock. The house is built with walls and roof of clay and cost Rs. 25. Several local gardeners have lately planted mulberries, and bring the leaves to the farm for sale, altogether the present prospects of the experiment are very encouraging. When mulberry shall have become more abundant in the neighbourhood it may be desirable to introduce improved reeling machinery, as upon this process the value of the silk mainly depends.

14. The teosmté seed sown on the farm produced a very heavy crop both in grain and fodder, it grows freely and all kinds of live stock are fond of it, both in the green and dry state. It bears transplantation and separation of the roots and is likely to prove a useful plant where a necessity exists for growing green forage, a one acre plantation is being laid out and the result will be given in figures in next report.

15. The seeds of the rain tree sent to the farm about 6 months ago turned out well, the tree is of easy and rapid growth, many have already attained a height of one to two feet, and all are healthy. The tree seems in every way suited to roadside planting.

16. The windmill pump has been re-erected and worked since the rains, and continues to give satisfaction, although the necessity for building a tank will always be against it as an *agricultural* machine.

17. Four new ploughs have lately been received and tried after having failed at Ahmedabad. Two of them are small *Turnwrests*, one each of wood and iron, these are constructed for ploughing hill sides; so that their capabilities can scarcely be tested on low land. One is a single moulding plough by the Boston Plough Company, and would be a useful implement in soil to which it is suited, a second by the same maker is a peculiar kind of double moulder, and works pretty well in garden land.

18. As much uncertainty exists concerning the quantity of water actually required by any irrigated crop, a series of experiments has lately been commenced with the view of determining the same. A fall board has been erected and a careful register is being kept of the water which passes over it. There can be little doubt that the very best land may readily be destroyed by over irrigation and *that* is particularly likely to take place where river water can be run on to the ground with little trouble, proofs of this are unfortunately only too abundant in the Punjab, Sind and other parts where inundation-irrigation is extensively practised. The Government farm at Salaru too is becoming sterilized by kálár. One field on the farm here is the subject of experiment to determine the rate at which this process goes on. After three years watering from the Jamda canal, a faint efflorescence appeared on the surface last season for the first time. This year it is more abundant and wheat has refused to grow in parts. I mean to continue irrigated crops yearly and note the result.

19. The strength of the herd has been increased by one Hereford bull, while two Amruth mahal bulls have been sent out in the district. The total home strength of the herd is at present 168, and made up as follows :—

Bulls of different breeds	...	25
Cows ditto	...	63
Steers ditto	...	21
Heifers ditto	...	46
Calves ditto	...	13
		168

20. Animals suffered a good deal at the commencement of the cold weather, from a disorder known as "khurgutti," the parts affected are the mouth and the feet, and is on that account often mistaken for foot and mouth ill proper, although really nothing more than a severe form of the fouls, or foul-of-foot of European countries. As many enquiries on the subject have lately been made, I may here state the treatment we have found most satisfactory in every respect. When the tongue has become sore and the animal refuses food, the upper surface is rubbed briskly twice a day with a mixture of pounded turmeric and common salt. The feet are kept clean by frequent washings with salt and water. If maggots make their appearance they are easily dislodged by means of tweezers after diluted carbolic acid or turpentine has been dropped into the sores. If promptly treated, recovery is rapid, but when the disease is allowed to get into its advanced stages the tongue rots and the hoofs sometimes fall off, and the animal is thrown out of condition for months.

21. The distribution of the farm cropping this year is as follows :—

Ordinary grazing ground	...	623 acres.
Meadow	...	54 „
Kharif (early crops	...	357 „
Rabi (late crop)		
A.—Irrigated 73 acres.		
B.—Dry 41 „	...	114 „
Gardens	...	10 „
Experimental Plantations	...	5 „
		1,163 „

Full details of the results of these crops will be available by the date of next report.

A. STORMONT,
Superintendent Government Farm.

BAMEIH COTTON.

FROM
THE SUPERINTENDENT GOVERNMENT FARM,
TO
The Collector of Khandesh.

SIR,—I have the honor to report the results, so far, of the experimental sowing of Bamieh cotton made here under Government Resolution No. 1257 of 9th March last.

2. The quantity of seed received was one quarter of a pound. A few packets of 100 seeds each were given to cultivators for trial, the remainder was sufficient to sow about 3 quarters of an acre.

3. The ground selected had been previously prepared for sugar canes and was rich in manure, and in excellent tilth. The seeds were planted on 28th June in lines four feet apart and four feet also from plant to plant, about 75 per cent. of the whole germinated, and the plants made astonishing progress for a few weeks when they were attacked by *aphis* which considerably checked them. After a time these disappeared and the plants started afresh and rapidly shot up to heights varying from 6 to 10 feet.

4. A very promising show of flowers was succeeded by a somewhat scanty supply of pods, a large portion of the former having been beaten to the ground by the heavy and persistent rains which also capped numbers of the plants.

5. The surviving trees have yielded only a few pods each, bringing up the entire crop, so far, to about 3lbs. of very long, but somewhat weak seed cotton. The trees are again sprouting luxuriantly from the roots, so that a second crop may be got further on in the season.

6. Although it is very improbable that the Bamieh cotton will be found suitable to a soil and in a climate such as that of Khandesh, yet the completeness of the failure in this case is certainly to some considerable extent owing to the unusually heavy rains, which in—Black land damaged severely even the hardy Dharwar American variety.

7. With regard to the history of the Bamieh cotton, I venture to think that some element of error must have crept in, in making the observations on which it has been framed. There is really little apparent difference between it and the ordinary Egyptian cotton, with the exception perhaps that the habit of the former is less bushy. The flowers, the seed, and the cotton of the two are scarcely to be distinguished.

8. Full particulars of this experiment will be available by the end of the official year.

A. STORMONT,
Superintendent.

Bhadgaon, 14th December, 1878.

AMERICAN HONEY.

AN experiment which has been successfully carried out by a firm of American wholesale grocers, is note-worthy as the first step to the introduction, probably on a large scale, of American honey in the comb. Last year a considerable trade was done in the exportation of honey from the United States to Europe, one New York firm alone sending over 300,000lbs. of honey, principally to Great Britain. The bulk of this, however, was sent in jars, either as pure extracted honey or as comb-honey—that is, honey bottled with portions of broken comb remaining in it. In the United States, however, honey, when sold in the comb, commands a much higher price than the honey sold in jars, and the efforts of honey-dealers there have long been directed to the production of small, clean, compact and perfect sections of honey-comb in a form readily saleable by the retail grocer. This object has been effected by placing sets of small boxes in the upper part of the hives for the bees to store the surplus honey in, and as each box is filled it can be lifted out and replaced by an empty one in which the bees may continue their labours. These boxes are now commonly made with four glass sides and a strip of wood at top and bottom. In size they are a square on five inches on the side by two inches in thickness, and a dozen of them are packed together in a crate for shipment. The advantage of using this particular form of box is that the bees finish off the section of comb in the shape and quantity found to be best adapted for sale and the seal of the bees upon each cell is the best guarantee for the purity of the contents. The difficulty of exporting these delicate pieces of comb without the loss of a great part of the shipment by breakages has hitherto prevented the growth of what might doubtless be a lucrative business. During four years Messrs. H. K. and F. B. Thurber and Co., of New York, have tried to get this comb-honey to England

in good condition, but without success. The want of proper machinery for unloading the ships seems to have been the principal cause of the damage. "Let down with a run" by a sling from the yard-arm, the glass boxes and their fragile waxen contents were again and again broken and spoilt. In November last, however, Mr. W. M. Hoge, the manager of this firm, succeeded in landing a consignment of 80 tons in Liverpool, and, encouraged by the result of the venture, he landed, at the London Wharf in Wapping, a lot of about 100 tons brought over in the *California*, one of the Anchor Line of steam ships. There are 2,500 cases in this shipment containing over 200,000lbs. of honey, and few boxes have sustained any injury in transit. Taught by past experience, Mr. Hoge had his cases securely boarded up between bulk-heads on the steamer, and in unloading employed gangs of men to pass the cases hand over hand down the ship's side into the lighter and from the lighter on to the wharf. Visitors to the Paris Exposition, where Messrs. Thurber and Co. obtained a medal for their honey, as well as one from the French Agricultural Society for the best honey in the most marketable form, may remember the exceedingly neat appearance of the honey-comb in these patent hive boxes.

The importance which bee-keeping has assumed as a regular branch of industry in the United States may be conceived when it is stated that over 35,000,000lbs. of honey are produced and sold annually. The tendency in this as in other occupations has been for the trade to be carried on by persons having large capital. The bee-keepers have frequently from 2,300 to 5,000 swarms of bees, and some far larger numbers. Messrs. Thurber and Co., for instance, have about 12,000 swarms of bees. Of course it is only by a thorough organisation that such large numbers of these little workers who toil without pay can be looked after and cared for. The system in the United States is to farm out the swarms. Arrangements are made with farmers and those who own orchards in suitable localities to allow an apiary of perhaps a hundred swarms to be placed in their grounds. At a distance of three or four miles another apiary will be placed with some other farmer. For this accommodation either a fixed rent or a share of the honey produced is paid, and the bee-owner sends expert workmen to clean the hives, to take out the boxes of surplus honey as they are filled, and to destroy the moths, grubs, and other creatures that take advantage of the bees' frugality. As showing the lucrative character of this business, it is said that a firm of shippers paid to one bee-keeper for his season's crop of honey a sum larger than the salary of the President of the United States. It is estimated that on an average one acre will support 25 swarms of bees, and, as the yield of a swarm is generally about 50lbs. of honey, it is evident that this trade may yet be greatly developed. Already the firm above mentioned, in addition to a corps of experienced bee-men to tend the hives, find occupation for nine men and two steam saws during five weeks of the year in cutting up the timber for the 72,000 boxes used to hold the comb-honey. The glass-makers also find some custom from the honey dealers, 144,000 panes of glass being required to make the sides and ends of those boxes. Much attention has been paid in the United States to the improvement of the breed of bees, and queen bees have been imported from Italy, Cyprus, and elsewhere for the purpose of improving the stock. Some years ago fine Italian queen bees were sold for as much as £10 each in New York, but by forming nurseries and rearing queens carefully selected from fine broods, queens of good blood, if a term may be borrowed from the turf, may now be bought at prices ranging from $1 to $5 each. Side by side with improvements in the culture of the bee, too, there have been many ingenious contrivances introduced in order to save the time and labour of the bees and of the honey-dealers. About ten years ago a German suggested that thin corrugated sheets of wax, which he called " artificial tablets," should be provided for the bees to make their comb from. These, however, did not come into general use, but a few years ago Mr. W. H. Hoge, effected an improvement by starting the side walls of the cells. When these " foundations," as they are called, were presented to the bees, the intelligent little creatures at once took advantage of them and extended the side walls so as to form the regular hexagonal cell. The machine by which the impression is made on both sides of the wax is very simple, and somewhat resembles a clothes wringing machine, only the iron rollers are studded with little hexagonal-headed pins just the size of the section of a cell, so that, when the thin sheet of wax is passed through, the wax is pressed up between the pegs to the height of about 1-16th of an inch, thus indicating the position and offering the substance for the construction of the cell walls. Another remarkable adaptation of machinery is afforded by the use of a rotating frame, which causes the cells of the con[illegible] placed in it to be emptied by centrifugal force. The empty, uninjured comb is afterwards replaced in the hive and again used by the bees. As about three-fourths of the time of the bees, it has been computed, is taken up in the construction of the comb, it will be seen that by these contrivances a great saving of bee labour is effected. With the rapidly increasing supply obtained by this well-organized system of bee-keeping, the dealers in honey in the United States are already trying to open new channels for the trade and to create fresh uses for the product of the hives. With this object in view a prize has been offered by the American Bee-keepers' Association for the discovery of a method of converting honey into the form of a crystalline sugar. Looking forward to a time, not, probably, far distant, when honey will be produced as cheaply as raw sugar,—honey may now be bought wholesale for 7 cents per lb. in California—the dealers hope to be able to provide a substitute for glucose which will equally well serve the purpose of the cook, the confectioner, and the brewer.

THE AGRICULTURAL CONDITION OF MYSORE.

We drew attention to an article in one of the leading English Agricultural papers on the condition of our agriculture as guaged by comparative statistics. We now furnish similar ones for Mysore, as shown in the Administration Report on 1874-75, a report written before the influence of the famine was felt. The total area cultivated in any way, whether as wet, dry, garden, or coffee, may be classed as follows :—

Cereals furnishing food	87·8 of total cultivated area.
Industrial crops	5·4
Garden crops (including coffee)	3·6
Perennial crops	3·2

We note, too, that in ten years the area cultivated with superior grains, forming the food of the bulk of the population, increased from acres 2,198,476 to acres 4,054,181, showing either the land diminished in productiveness, or that the demand was intensified year by year by increased population and export, or that both causes were acting together. It is difficult to classify these crops as exhaustive or restorative in the way crops are so considered in England, unless, indeed, we consider all but garden crops exhaustive. We can, however, arrive at a useful comparison by comparing the quantity of live stock in Mysore, which, as far as can be ascertained, is practically stationary in numbers, with that of England. In 1875 Mysore possessed

		Per square mile of territory. Mysore.	England.
Cows & bullocks	29,21,962	108	66·5
Sheep & goats	21,84,594	86	825·0

On to bring it to figures that will give an idea of the manure supply per 100 acres of arable land by calculating five sheep equal to a bullock, and including other stock in proportion, we get in Mysore

	Per 100 acres arable land.
Cows and bullocks Sheep and goats, calculated to cattle Other stock ditto ditto	104 head.

or about a bullock per acre for cultivating and manuring.

We presume the agricultural authority in Mysore has brought these facts to the notice of the Famine Commissioners, who will, we fear, glean a very imperfect notion of that province by their visit to Bangalore Even if they have time to visit its environs they will see anything but an average tract of country. The paddy-lands and ragi-fields surrounding the town are heavily manured, the market gardens are the finest in the province, and numbers of fine cattle used by the cartmen are far above those usually employed by the ryot. Ocular evidence is so impressive and so much more likely to be lasting than knowledge acquired by reading papers that the real condition of Mysore is hardly likely to be believed unless a journey were taken, not through a selected tract of country, but across fifty miles as the crow flies. Mr. Elliott knows much of the province, as also does Mr. Runga Charlu, but how can Mr. Caird glean the exhaustive facts about its agriculture and agriculturists that he pre-eminently should possess before giving a verdict? We fear the cry " Perish India" raised by the opposition to the party in power in Parliament, would receive too many facts to favour it, if our agricultural distress be brought too prominently forward; hence we have actually heard it reasoned, the evident straining to show selected areas that but too favourably represent the average condition of the country.

EXPERIMENTAL FARMS.

Resolution by the Government of India.

In his despatch dated the 7th February 1878, the Secretary of State noticed an experiment at the Nagpur Model Farm in 1876-77, where, in consequence of irrigation and manuring, Jelalia wheat produced 1,600 lbs., and white-eared wheat 2,200 lbs., an acre, the average yield per acre in the country being only about 400 lbs. The value of the produce at Nagpur was estimated at Rs. 60, while the cost of cultivation, including all expenses, was given at Rs. 10 per acre. His Lordship desired to be informed " what steps are taken in the above and other provinces to impart to the agricultural community generally the lessons to be learnt from the operations of the model and experimental farms ;" and observed, " as in many cases these farms appear to involve financial loss, it is the more important that their results, when satisfactory, should be utilized to the utmost for the general good of the country."

2. A copy of this despatch was circulated on the 21st March 1878 to the Governments of Madras, Bombay, and the North-Western Provinces and Oudh, and to the Chief Commissioners of the Central Provinces, British Burma, and Mysore, with a request for a report in connection with the farms maintained under their orders.

3. In Mysore, the Chief Commissioner states that no general steps have hitherto been taken in the direction indicated, the condition of the province during the past two or three years having forbidden any such measures. Mr. Harman, the superintendent of the Bangalore Farm, has recently been authorised to make tours in the province twice in the year, once in the summer when the *ragi* crops are being sown, and again during the winter months when the crops are being reaped, in view to his acquiring practical experience in the native systems of agriculture and imparting to the ryots by personal communication and by experiments the benefits of deep ploughing, as also the advantages to be gained by the use of improved seed. The Chief Commissioner has also under consideration a scheme for placing one or two plots of land in each district under the charge of a village patel or other suitable person, who would cultivate the land in accordance with instructions from Mr. Harman. "By this means," the Chief Commissioner observes, "it is hoped that the ryots will have an opportunity, which the location of the Government Farm at Bangalore does not afford them, of judging of the results to be obtained by a better system of farming." Since these remarks were written, however, it has been decided to abolish the Bangalore Farm and to transfer the services of Mr. Harman to the Bombay Presidency.

4. In Burma, the only Government Farm is one established at Myouktoung in the Aracan Hill Tracts for the purpose of growing and curing tobacco. As regards the cultivation of tobacco on the low lands lying along the banks of rivers, the natives have but little to learn: the farm was started with a view of testing the capabilities of soil in upland tracts, and more especially for the purpose of teaching the people an improved method of curing the leaf; but there has not been time to judge of the results as yet.

5. Mr. Buck, Director of Agriculture and Commerce, North-Western Provinces and Oudh, in reporting on the subject, refers to that portion of the minute recorded by Sir John Strachey in November 1874, proposing the formation of a Department of Agriculture in the North-Western Provinces, in which it was suggested that a good means of reaching the agricultural community would be by experiments in the estates under the Court of Wards. This suggestion, it is said, has been carried into effect, though not to so great an extent as was desired, in consequence of the drought of 1877. To some estates, however, improved English ploughs, improved sugar-mills, and selected seeds, were sent; and in some districts, where the local officers took an interest in agricultural matters, seed and implements were distributed to estates other than those administered by the Court of Wards. As a further means of introducing improvements to the notice of the agriculturists, Mr. Buck lays great stress on the advantages of agricultural fairs; and he proposes to give greater encouragement to such fairs in future years. No attempts seem to be made by the Local Government to bring directly to the notice of the natives the results of the experiments conducted on the State Farms.

6. There are two Government Farms in the Bombay Presidency, one at Bhadgaon in Khandesh and the other at Salaru in Sind. At Salaru, nothing has as yet been done in the desired direction; but the superintendent proposed making a tour in the cold weather months, during which he would acquire and diffuse useful information. He is to report the results of his first tour, in order that the Government of Bombay may be in a position to judge of the desirability of repeating the experiment.

At Bhadgaon, too, little appears to have been attempted. The superintendent reports that the instruction is imparted through farm apprentices, farm servants, and visitors. The system of apprentices, if carefully worked, would no doubt prove useful; but nothing can be expected from farm servants as a means of imparting agricultural information to the native community. Mr. Stormont, the superintendent, recently visited Madras and Bangalore, under authority from the Government of Bombay, with a view to ascertain the system followed on the farms at those places; and he was instructed to report the result of his enquiries on his return to Khandesh.

The Local Government has also, after consultation with Mr. Robertson of the Sydapet Farm, decided on commencing a system of agricultural education in the Deccan, and probably, in due course, the Bhadgaon Farm will be made subsidiary to the scheme of instruction.

7. In the Central Provinces, Major Macdougall, the superintendent of the Nagpur Farm, proposes to publish the results of "any decidedly successful experiment" in the *Rural Gazette*, a paper printed in Hindi, Mahrathi, and Urdu by the Educational Department, of which a copy is sent to every Government school in the Central Provinces. The Chief Commissioner approves of this proposal; but such a means of making known the operations of the farm seems scarcely to be what is required, the record of these experiments being useful to the agricultural community only when they can be followed and explained on the farm on which they have been tried.

8. In the Madras Presidency, good and useful work is being done under the supervision and guidance of Mr. Robertson, the superintendent of Government Farms. Attached to the Sydapet Farm, on which experiments of various kinds are tried, is an Agricultural College, in which a complete course of agricultural instruction is afforded, and which is intended eventually to accommodate upwards of one hundred students. In view to a further diffusion of information, Mr. Robertson has proposed the establishment of small agricultural experimental stations all over the Presidency, each being placed in charge of a trained agriculturist, who is also to conduct an elementary agricultural class. This scheme is, however, at present in abeyance for want of funds.

Recently, a very interesting ploughing competition was held at the Sydapet Farm, in which European, American and native ploughs were used, the competitors as well as the visitors from different parts of the country being very numerous. Such open competitions as these afford an efficient means of interesting neighbouring cultivators in the methods and processes of the improved system of agriculture practised on the farm. The public reports shew that the exhibition was watched with very great interest and was completely successful.

9. From the facts summarised above, it may be said generally that only in the North-Western Provinces and Madras is any real effort being made to teach agricultural reform to the people. In the North-Western Provinces, a Department of Agriculture and Commerce has been created, with a Director at its head, whose special duty it is to organise the collection of agricultural and commercial statistics; to direct experiments for agricultural improvement in model farms and elsewhere; to watch and report on the progress of trade, and to suggest in what directions it may be developed, or hindrances to its prosperity removed; and to investigate facts connected with the condition of the agricultural classes. The scope and objects of the Department are clearly explained in a minute recorded by Sir John Strachey in November 1874, to which the attention of the Local Governments and Administrations was drawn in the letter from this Department dated the 11th August 1875, Nos. 11—426-433, regarding the collection of agricultural statistics.

In Madras there is a Department, which, though not as yet formally recognised as a Department of Agriculture, is practically one, with an efficient and well qualified director at its head; but its expansion has hitherto been greatly impeded by various causes, not the least among which has been the want of funds.

10. In other provinces very little is being done, nor as matters stand can much be expected. Experimental farms indeed, when they stand alone, are of comparatively small utility. To be really useful they should be part of a system of agricultural instruction; they should be attached to a school where sound agricultural instruction is conveyed in class, and they should be the field for carrying into practice in the presence of students the theories of which the lessons have been explained to them in the class-room. If the students are taken from the classes dependent on the land for their living, satisfactory progress in the diffusion of agricultural instruction under such a system will soon be apparent. It is with much satisfaction that the Government of India has watched the recognition of these principles in Madras and the efforts that are being made there gradually to mature a complete system for their application in practice. The system for action in the same direction which has just been proposed by his Excellency the Governor of Bombay is also gratifying as indicating the interest taken in the matter by the Government of that Presidency. In other provinces much cannot be expected under the present system, though, defective as it is, the farms, if they are carefully and intelligently managed, intelligently supervised, and placed on a substantial and permanent basis, must gradually do good, and the Government of India desire again to commend the subject very earnestly to the attention of Local Governments and Administrations. Bengal especially is a province which is singularly deficient in opportunities for agricultural instruction, while it is perhaps of all Indian provinces the one where a reform of practice is most needed. It is also the province of whose agricultural resources and capacities the governing body knows least. It is a matter of more than ordinary importance that the cultivating and wealthy land-owning community in this great province should be taught to realise the advantages of a better agricultural practice, and that steps should be taken to remove the reproach which now exists, that the very elements of agricultural information, such as the average yield of particular crops in particular soils, are wholly absent. Efforts in this direction were made some years ago by Sir George Campbell; but these efforts, though well intentioned, were frustrated by radical errors in the selection of sites for farms, as well as in the selection of superintendents. The results were so unsatisfactory that the farms were broken up one after the other, the last being abolished in 1877, on the ground that all the attempts which had been made to teach agriculture to the people of the country had ended in failure. This conclusion was not accepted by the Government of India, and it is desirable in connection with the present question that the views then expressed to the Government of Bengal should be brought prominently before other Local Governments and Administrations. In the letter from the Government of India to the Government of Bengal dated the 4th May 1877, No. 91, it was said:—

"His Excellency in Council is by no means prepared to admit that, because it is not necessary at present to teach to the natives on a scientific basis all the technicalities of the highest farming, there is therefore no opening for instruction of a highly useful, if of a more modest kind, adapted to the present educational and agricultural standard of the country. His Excellency in Council is unable to agree with his Honor the Lieutenant-Governor in the opinion that the attempts of the Government to teach agriculture to the people have failed everywhere. Where these attempts have failed, as at Poosah, failure has been the result of inefficient management; but where ordinary care and attention have been intelligently given to the subject, it is unquestionable that, as at Sydapet in the Madras Presidency for instance, good results have ensued.

"5. It is not necessary to employ specially qualified agricultural chemists for the purposes contemplated by Government in the establishment of model or experimental farms. The objects of the Government have been frequently stated, but they have been well and briefly summarised by Sir John Strachey in the following extract from his minute of the 28th November 1874, proposing the creation of a Department of Agriculture and Commerce in the North-Western Provinces:—

"'The object of these model farms should be three-fold: first, to obtain complete information, based on actual facts, as to the average productiveness of different crops on the different classes of soil on which they are ordinarily cultivated, and the cost of cultivation; secondly, to establish and prove to the agriculturist the advantages to be gained from small improvements, such as they are able themselves to carry out under existing conditions, such as deeper ploughing, economical use of canal water, selection of seed, &c., thirdly, to make experiments as to staples and industries which it may be possible to introduce if new, or to familiarise and improve if already existing in the country. The extension of sericulture, the improvement of indigenous fibres, and the manufacture of a finer class of tobacco, may be mentioned among the objects of such experiments."

"It is to these objects that attention should be particularly directed. It is evident that lessons in such matters, especially under the second head, and instructions in such details (important though they are) as the proper storage and application of the manures ordinarily employed in the country, shewing experimentally how they may be made to retain all their fertilising elements, of which much is now wasted, the proper treatment and breeding of live stock, improvement of the implements employed, and other similar matters, may as successfully be imparted by an energetic man of fair intelligence, possessing an adequate practical knowledge of modern farming, (and consequently having such knowledge of agricultural chemistry as is essential to the successful pursuit of modern farming), as by a professional chemist of high scientific attainments.

"The Governor General in Council is convinced that lessons of this kind are urgently needed, and that if measures for the elementary instruction in such matters of the agricultural community are persevered in by the Local Governments (without whose cordial co-operation nothing can be done), they cannot fail after a reasonable time to have very considerable effect upon the cultivators in the neighbourhood of the Government farm and through them upon others further away."

11. The excellent results which have followed the creation of a Department of Agriculture, and Commerce, in the North-Western Provinces, in the impulse which has been given by it to agricultural enquiry and improvements, indicate perhaps the best form in which Government action can be directed to the promotion of the objects in view. With the establishment of such a Department in each province (and it is maintained in the North-Western Provinces entirely from provincial funds) the extension of the system, whether by agricultural instruction in schools, or by practical teaching in experimental farms, or where means are available by a combination of both, could be regulated under efficient control and advice according to the particular requirements or circumstances of each province. From this point of view the Governor General in Council will be glad to learn that the matter has again received from the Government of Bengal and other Local Governments and Administrations the consideration which its importance merits, and he would wish to be informed at an early date of the results of that consideration.

PROFESSOR WILSON ON FRENCH AGRICULTURE.

THE Class of Agriculture in Edinburgh University was opened on November 18, by Professor Wilson, who directed attention in his introductory address to French agriculture. It was, he said, of great benefit to agriculturists that they should become acquainted with farming as it was carried on throughout the Continent, seeing that one could not pass through any well-farmed bit of country without noting new practices, which, if carefully studied, might be found suitable for application at home. In the summer he had, he mentioned, visited Paris in company with Mr. Fletcher Menzies, to attend the International Agricultural Congress, and when there he had an opportunity of examining the different kinds of French stock. Of cattle there were some fifteen distinct breeds, kept principally for working purposes. In the front rank of these stood the Charolais, which were admired by everybody, and which in their points, appearance, and quality were equal to some English shorthorns. In several of the breeds a marked improvement had been effected by crossing with English sires—a fact which showed that it was better to seek after the improvement of a native breed than merely to set about supplanting it altogether. Among their sheep, which it was well known were for the most part merinoes, crossing had also been introduced, with what success might be judged when he mentioned that two pens were shown to him, the one containing high-class pure merinoes weighing 103 lbs. a head, and the other some crosses between Southdowns and merinoes of the same age, weighing 220 lbs. The clip of the different lots was, he believed, in the same proportion. In one respect French sheep-farming differed very much from what was known in this country—the application of ewe milk to cheese-making. Many of the high-flavoured cheeses thus made were well known in this country. Of one variety, called Roquefort, 3,000 tons were made every year, for which quantity the milk of 250,000 ewes was necessary. A ewe would on an average give about 25 lbs. of cheese annually, on some farms fully as much as from 40 lbs. to 50 lbs. being got from a good, well-fed, well-cared-for ewe. In regard to the breeding of horses, he explained that the French Government took a paternal interest in the improvement of the stock of the country, being the possessors of some 2,500 good stallions, which were stationed at specified places, and the use of which by farmers and others was calculated to improve the class of roadsters. He also mentioned that schools existed at which instruction might be had as to the proper mode of breaking in young animals. Another peculiarity to be noted in France was the extensive use of mules and asses. In one district alone there were 28,000 of these animals, the mules bred from jack-asses and mares. The jack-asses were, he stated, kept solely for breeding purposes, and were on that account much valued, selling from £100 to £500. In their rearing of pigs the French had not made much progress by crossing; but in the breeding of rabbits, pigeons, and poultry they did wonders. Near Paris there was a large number of small farmers, holding from 10 to 20 acres, or even less, who devoted themselves to the rearing of rabbits, which were brought to a great size; and by these men a thoroughly good thing was made from the business. Pigeons, as big as poultry, were sent to market in the same way and the attention paid to poultry was indicated by this, that last year the French sold 1,000 millions of eggs, over and above what they used themselves—a sale which represented about two millions and a half of money. This latter circumstance was, he submitted, one which should be laid to heart by the farmers of this country, as any such point was in the meantime entirely neglected at home. Bee-farming was another occupation carried to much perfection in the sister country, there being in Brittany 307,000 hives, and the honey produce of the province being worth £150,000. In concluding his remarks he suggested that there might possibly be some places in this country where potatoes and corn could not be profitably grown, but where it might be well for the tenantry to give more attention to those minor branches of farming which were found to pay so well in France.—*Ayr Advertiser.*

ROOT CROPS AS FOOD AND MANURE.

AT the opening meeting for the season of the Cirencester Chamber of Agriculture, Professor Church read an interesting paper, of which the following is a portion:—All foods have to be valued, not only according to their absolute richness in the several constituents of food, but also in regard to the ratio which these constituents bear to each other. As these constituents may all be regarded as nutritive, though in different degrees, it is convenient to speak of them as nutriments. There are six:—1, water; 2, flesh-formers or nitrogenous matter or albuminoids; 3, starch, sugar, and carbohydrates; 4, oil and fat; 5, fibre; 6, mineral matter or ash. My chief object to-day is to bring before you the results of some analyses of roots which have been made by an improved process. These results mainly touch the second item of our list, flesh-formers, but they seriously alter the accepted theoretical value of roots as food by showing another kind of error in our estimates of their feeding value, an error in the ratio between this second group of nutrients, or the flesh-formers, and the third and fourth groups taken together or the heat-givers. Incidentally, I shall allude further on to the functions and uses of most, if not all, of the six groups of nutrients, but it is expedient to explain at once what is meant by this ratio in question. I shall call it the 'nutrient ratio,' and to avoid decimals shall assume that we are always dealing with 10 parts (be they grains, ounces, or pounds, or more abstract quantities), of flesh-formers (or nitrogenous compounds of vegetable origin, but like the albumen of eggs, the casein of cheese, or the fibrin of meat). If we look at those kinds of natural herbage which best sustain the health and growth of our farm animals—we look at those artificial foods which bring them to an early maturity, we shall find that the nutrient ratio shows a high proportion of flesh-formers. But the range is very extensive—from 8 to 10 in decorticated ground nut-cake to 200 to 10 in sugar-beet. The richest pasture grass will give 38 to 10, the poorest 90 to 10. We cannot fix a nutrient ratio which shall be equally adapted for all animals at all stages of the feeding process, but we can ascertain by direct experiment what ratio gives the best result in the particular circumstances of each case. To calculate the nutrient ratio we add together the percentages of starch, of sugar, and of all other nutrients of the same group, called the carbohydrates; then we multiply the percentage of oil by 2½, and include the result in the total sum of heat-givers. The percentage of flesh-formers having been ascertained by analysis, we arrive at our ratio by a simple sum of proportion. Now the chief cause of these calculated ratios being wide of the truth in the case of roots and succulent fodder plants, arises from the simple fact that it has been the habit of agricultural chemists to reckon all the nitrogen found in these foods as existing in the useful form of flesh-formers, while in reality this is not the case. On two former occasions (1873 and 1874), I pointed out this fact to the Chamber, and it has at last attracted general attention. I cannot claim the credit of discovering this fact, for Lawes and Gilbert pointed it out with distinctness in a paper read before the British Association so long ago as 1852.

FALLACIES OF ANALYSIS.

In October 1875 I announced some startling corrections of the current view obtained in 1874, but almost too startling to secure my own belief at that time. But other methods in the hands of foreign chemists having confirmed my figures, I was able to say that the mangel must be placed below the swede, and even the turnip, so far as richness in flesh-formers was concerned, the comparison being made with roots grown side by side under precisely the same conditions. My mangels showed less than one-fourth of the flesh-formers with which they would have been credited, had the ordinary process of analysis been followed. I do not mean to affirm that such a result would be invariably obtained, but subsequent experiments enable me to say that from one-third to three-fourths of the nitrogen of this root exists in forms useless for food, though excellent as manure. This fact of course obliges us to alter the nutrient ratio. To show how far the new results differ from the old, I give these numbers—

FLESH-FORMERS IN MANGELS.

Variety of root.		Water.	Flest-formers by old process.	Flesh-formers by new process.
		Per cent.	Per cent.	Per cent.
Feeding beet	...	94·0	1·432	0 63
Yellow Globe	...	93·7	1·025	0·53
Long Red	...	91·5	1·080	0·51
Golden Tankard	...	90·1	1·510	0·57

These roots were exceptionally large and watery, so that these figures must not be taken as representing the average richness of these varieties of mangels. Yet the above percentages confirm the statement that half of the assumed flesh-formers of mangels may be non-existent. Of 12 analyses published in 1876-7 of different varieties of mangels, and given in the German *Year Book of Agricultural Chemistry*, the lowest assumes 0·92 per cent. of flesh-formers, and the highest 1·75, the mean being 1·32; it is probable that this number should be halved to represent the truth.

MANURE EXPERIMENTS WITH OATS UNDER GLASS.

We have been favoured with a copy of the report of interesting experiments with different manures in the growing of oats, conducted during last season by Mr. J. Scott Dudgeon, at Longnewton Place St. Boswells. The experiments were on oats grown in pots under glass with different manures; and the report, which forms part of the annual issue of the Chemical Agricultural Association of Scotland, is certain to interest most of our readers. We give the following extracts:—

The objects of the experiments, full details regarding which are given in accompanying tables, may be roughly stated as follows: —1. To test the cheapest source of phosphorus and nitrogen. With this view coprolites and bone-ash were chosen, and these were tried in their natural state—reduced to as fine a powder as possible in a pestle and mortar; and also in their dissolved state—acted on by sulphuric acid. The first eight experiments were devoted to this object, the first four having an addition of nitrate of soda, and the last four an addition of sulphate of ammonia. The cost in each case is pretty much the same—say 2s. 6d. per acre in favour of the mineral, and the proportion of phosphorus in each almost the same—viz., 36½ per cent. where undissolved, and 24 per cent. were dissolved. Nitrate of soda and sulphate of ammonia were also tested against one another, as sources of nitrogen, the quantity in the nitrate of soda application being slightly smaller than in the sulphate of ammonia, as also is the cost—3 per cent. less in quantity of nitrogen, and 2s. 6d. per acre in cost. 2. To test an equal money value application of other light manures against those already mentioned, as well as against one another, and with this object Peruvian guano, dissolved Peruvian guano and fish guano formed the next three experiments, while another was devoted to an application of dissolved bones, with an addition of nitrate of soda at a very similar cost per acre. 3. To test the value of an addition of potash. For this purpose Nos. 13, 14, and 17 of the subjoined table were allotted. 4. To test Peruvian guano as the source of nitrogen against nitrate of soda and sulphate of ammonia. With this end in view Nos. 16 and 17 were made, and compare most directly not only with Nos. 12 and 14, but also with all the others. 5. To test the relative result from a medium application of farmyard manure, for which purpose No. 18 was added. 6. To test a plot without any manure as a comparison with all the others and so to discover what beneficial results in a remunerative sense follow.

The scene chosen for the site of the experimental house was a sheltered hollow, fully exposed to the influence of the sun, and about 500 feet above sea level. The structure erected to contain the thirty-six experimental pots was 14 feet long by 7½ feet wide, the roof sloping from 7½ feet to 6 feet high. The roof was composed of glass, in four sashes of 3½ feet wide and 8 feet long each. The enclosure was made of rough wood, boarded at top and bottom for about a foot, while the sides were formed of ¾ inch wire netting. The experiments were conducted in earthenware pots 12 inches in diameter and of the same depth, resting on boards off the ground, slates being placed beneath each, so that the roots could not penetrate into the soil beneath. The pots were placed among riddled ashes, to preserve them from drought and sun. The soil used was all taken from a field close at hand, which was cropped with oats the previous year, and is a thin poor clay. It was taken spade deep, and afterwards well mixed and riddled, and one-fourth of small stones, riddled from gravel, mixed with the soil to keep it open. In preparing the pots a depth of 2 inches of stones or gravel was put at the bottom of each pot, followed by 8 inches 'soil.' The seed oats were then deposited to the number of twenty grains in each pot, the manure sprinkled over them, and the remainder of soil added. Analyses of the manures were made before application, and the quantities accurately weighed in the laboratory in Edinburgh. There were two pots of every number; thus each experiment was made in duplicate, and arranged in relative positions in the house.

The duplicate pots of each experiment were under as dissimilar influences as possible as regards situation, one of each occupying an inside position, and the other an outside. The crop selected for the experiments was grey oats, twenty selected seeds of which were put into each pot, and the sowings were made on the 6th and 10th of April (No. 18 on 20th April). All were up, except the last sown, about the 30th April, and they were thinned out by degrees, as they seemed healthy, to ten plants each pot, the thinning being completed by the end of the first week in June. Some plants were attacked by grub or some other pest, and some pots were consequently unequally planted, and had occasionally a weak plant or two left. The plants were watered at first once each day in the evening; but during hot, dry weather they were watered twice—morning and evening. They never were soaked, being only kept moist. About the 2 th July they 'shot' out to head, some partially, others quite out, and by the 27th July *only* all were really 'shot.' Great diversity was observed in the different pots in point of earliness and lateness in shooting. The plants that grew best and looked best at first, about the beginning of July began to fall off, while those later and more backward at first began to come up to the others and promised better; notably those with applications of phosphates in the undissolved state were most backward and unpromising for long, but latterly improved in a very marked way, and when ready for the sickle appeared quite as "gifty" as those which had promised better in the earlier part of the season.

It may be interesting to reproduce a series of observations, made on the 27th of July, as to the growth and appearance of the various pots at that date, which may be compared with the results as ascertained by the scales after harvesting. Between 1 and 3, mineral dissolved and undissolved, with the addition of nitrate of soda, there was little perceptible difference. Between 2 and 4, bone-ash dissolved and undissolved, with nitrate of soda, there was again little difference, if anything in favour of the undissolved. In the case of 5 and 7, mineral dissolved and undissolved with sulphate of ammonia there was no decided difference, the dissolved in each instance being the earlier. Between 6 and 8, bone-ash dissolved and undissolved, with sulphate of ammonia, the palm might be awarded to the undissolved. In the case of 1 and 5, dissolved mineral, with nitrate of soda and with nitrate of soda and with sulphate of ammonia, there was no difference, if at all, in favour of the nitrate. Between 2 and 6, bone-ash, dissolved with nitrate of soda and with sulphate of ammonia, there was little difference, perhaps the latter had it on the whole, and in the case of the pot to the south most decidedly. No. 3, mineral and nitrate of soda against 7, mineral and sulphate of ammonia, here the nitrate was best; as was also the case in the experiment with 4 and 8, bone-ash, with nitrate of soda and with sulphate of ammonia. There was no decided difference between 9 and 10, Peruvian guano, dissolved and undissolved, both being short of some of the former applications, and both earlier. Fish guano (11), compared with Peruvian guano (9 and 10). At first the former looked very badly, and was later, but having improved, now compared similar to the latter applications. In the case of 12 and 16, dissolved bones with nitrate of soda and with Peruvian guano, it was thought that the latter would prove the better and the cheaper, indeed, from the then appearance, it seemed likely that 16 would turn out the best of the whole applications. Nos. 13, 14, and 17, which have each an addition of potash, when compared with 1, 12, and 16—the same applications without the potash—indicated no perceptible superiority. No. 15, which is credited with 'nothing,' has all along thriven well, it brairded regularly, and has continued healthy, and though weak and never strong looking, still promised better than could have been expected. The crop was cut at two different dates. On the 28th of August, Nos. 16, 14, 13, 10, 9, and 11, to the south, being fully ripe, were cut, and the others on the 4th of September—being all quite ready for the sickle, with the exception of No. 4 to the south, No. 7 to the north, and No. 11 to the north, and both pots of No. 18, which were all a little green. The same variety of oat, sown in the field in the ordinary way, on the 8th of April, was cut on the 24th of August, showing that the influence of the glass had not in the least degree forwarded the growth of those under experiment. Indeed, there was no perceptible increase of temperature inside the structure; the sides being fully open, permitted free circulation of air at all times. After being allowed thoroughly to 'win,' they were carefully thrashed out, the grain and the straw of each pot being put in separate parcels, properly numbered. And on the 30th of September these were all weighed in Mr. Falconer King's laboratory.

The following table shows the quantities and cost of manure applied per acre, and the percentage of phosphorus and nitrogen which each application contained:—

No.	Manures.	Cwts. per acre.	Cost per acre. s.	d.	Total. s.	d.	Percentage of phosphorus.	Percentage of nitrogen.
1	Mineral Superphosphate... and Nitrate of Soda ...	3·33 1·11	14 17	7 5	32	0	24·75	17·76
2	Bone Ash Superphosphate and Nitrate of Soda ..	2·66 1·11	17 17	3 5	34	8	28·14	17·76
3	Coprolites (finely reduced) and Nitrate of Soda ...	3·33 1·11	15 17	0 5	32	6	36·63	17·76
4	Bone Ash .. ... and Nitrate of Soda ...	2·66 1·11	17 17	3 5	34	8	36·4	17·76
5	Mineral Superposphate ... and Sulphate of Ammonia	3·33 1·	14 20	7 0	34	7	24·75	20·5
6	Bone Ash Superphosphate and Sulphate of Ammonia	2·66 1·	17 20	8 0	37	8	28·14	20·5
7	Coprolites (finely reduced) and Sulphate of Ammonia	3·33 1·	15 20	0 0	35	0	36·63	20·5
8	Bone Ash ... ... and Sulphate of Ammonia	2·66 1·	17 20	8 0	37	3	36·4	20·5
9	Peruvian Guano ...	2·66	......		33	6	13·	22·
10	Dissolved do. ...	2·66	......		32	0	15·	17·
11	Fish do.	3·	......		38	9	15·6	26·4
12	Dissolved Bones ... and Nitrate of Soda ...	2·66 1·11	20 17	0 5	37	5	26·	17·76
13	Mineral Superphosphate... Nitrate of Soda ... Muriate of Potash ...	3·33 1·11 ·771	14 17 7	7 5 9	37	9	24·75	17·76
14	Dissolved Bones ... Nitrate of Soda ... Muriate of Potash ...	2·66 1·11 ·771	20 17 5	0 5 9	43	2	26·	22·2
15	Nothing.							
16	Dissolved Bones ... Peruvian Guano ...	2·66 ·888	20 10	0 6	30	6	30·4	12·
17	Same as No. 16, with Muriate of Potash ...	 ·771	30 5	6 9	36	8	30·4	12.
18	Farmyard Dung (wellrotted)	156·	58	6	58	6		

Mr. Scott Dudgeon set to work with the laudable objects of testing the cheapest source of phosphorus and nitrogen, the efficacy of potash added to other manures, the comparative value of the Peruvian guano of the present day, and the superiority or otherwise of farmyard dung as a dressing for oats. The pots which got undissolved phosphates gave a better return of grain, though rather less straw, than those to which dissolved phosphates were applied, each getting a similar allowance of nitrogen. The mean of the several pots devoted to the solution of this question showed an increase of 87 bushels of grain per acre in favour of the undissolved phosphates, but the dissolved gave 1½ cwt. more straw per acre. Nitrogen having been applied along with phosphates, the above result will not astonish practical farmers.

Coming to a comparison of the pots which received their nitrogen in the shape of nitrate of soda with those getting sulphate of ammonia, we find that on the average the latter has the advantage, though not to a very large extent. The difference in favour of sulphate of ammonia is 1 cwt. of straw per acre and 1½ bushel of grain. The difference in price of the two articles was 2s. 7d. per acre, the sulphate being, of course, the dearer. Estimating the grain at 3s. per bushel, and the straw at 2s. per cwt., it will be observed that the dearer article is in the end the cheaper by about 4s. an acre. Many farmers would not have been surprised though the difference in favour of sulphate had been even greater.

The value of potash salts has been very distinctly brought out. The pots which received no potash yielded on the average 59·1 bushels grain and 27·8 cwts. straw per acre, while those which obtained about three-fourths of a cwt. of muriate of potash per acre yielded 65 bushels grain and 28·6 cwts. straw. There was thus an increase of about 6 bushels of grain and nearly 1 cwt. of straw produced by the addition of 5s. 9d. worth of potash, or a money gain of about 14s. per acre.

In reference to the source of the phosphates, the results are very interesting, and generally accord with the experience and opinion of many of the best farmers. The four pots where phosphates were derived from bone ash gave a mean of 61·9 bushels grain and 29·8 cwts. straw per acre; while those manured with phosphates from coprolites produced only 64·4 bushels grain and 26·8 cwt. straw. The superiority of bone ash is here, as on many a farm, decided, the difference being 4½ bushels of grain and 3½ cwts. of straw per acre The bone-ash phosphates cost 2s. 8d. per acre more than the other; but this additional outlay gave extra return of about 20s. per acre. This does not accord with the experiments of the Aberdeenshire Agricultural Association, only the latter have as yet been confined to turnips, which may account for the varying results. Mr. Dudgeon's conclusion in this matter will, nevertheless, substantially agree with the experience of a large number of Scottish farmers.

For several years back complaints have been frequent regarding the inferiority, or, at any rate, the variety and uncertainty, of the quality of the so-called Peruvian guano. Less than twenty years ago the Peruvian guano then obtainable formed the best top-dressing for cereals. Latterly, however, this article has deteriorated so much that confidence in it has been considerably shaken, nor will the experiments under consideration tend to strengthen that confidence. Two and two-thirds cwts. of Peruvian guano in No. 9, it will be seen, produced 55 2 bushels grain and 25·5 cwt. straw per acre, while the same quantity of dissolved Peruvian guano in No. 10 gave the worst results of all, showing only 2·6 cwts. more straw and actually 1·3 bushels less grain than were reaped from No. 15, which got no manure of any kind. No. 11, manured with fish guano, is better, but still considerably behind the produce of the pots to which the mixed artificial manures were applied.

Used along with dissolved bones, however, the Peruvian guano has done better, and beats in a substantial manner nitrate of soda. The mean of the pots manured with dissolved bones and Peruvian guano topped that of those manured with dissolved bones and nitrate of soda by 5½ cwts. straw and nearly 7 bushels grain per acre. The difference here is rather more decided than many people would have expected.

The largest return stands to the credit of good farmyard dung. No. 18 was manured with this article alone at a cost of 58s. 6d. per acre, which was by 15s. the dearest to start with, though it turned out the cheapest in the end. From the application of the farmyard dung there was a return of 80·9 bushels grain and 45·9 cwts. straw. As compared with the pots which got no manure, there was thus fully 4 qrs. grain and 25·3 cwts. straw due to less than £3 worth of dung, which indicates a handsome profit.

A comparison of the pots which indicate a profit on the application with these which show a loss as regards the percentage of phosphates and nitrogen, is interesting as bringing out the effect which the percentage of phosphates apparently has on the yield of grain. 'Those,' says Mr. Dudgeon, 'which gave a profit of above 20s. per acre, viz. Nos. 3, 4, 8, and 17, contain on an average 35 per cent. of phosphates and only 17 per cent. of nitrogen; while the pots which indicate the greater loss, viz. No. 9,10,11, and 13, contain only 17 per cent. of phosphates and nearly 21 per cent. of nitrogen.'

Mr. Dudgeon concludes his valuable report with the following observations in favour of experiments under glass:—

'That experiments can be conducted, with the hope of any good results following therefrom, on the limited scale these are being carried on, I know is questioned by many. They no doubt have their drawbacks in comparison with those conducted on a large area in the open field, but, too, they have many advantages which are apt to be overlooked, and to some of these I would draw attention. 1st. The quantity and quality of the soil used can be made exactly uniform in the case of each and every one of the series. 2d. The plants grown are confined absolutely to the portion of soil and manure allotted them. 3d. Exactly the same number of plants can be employed in each experiment, and from easy observation and judicious thinning out, &c., kept nearly uniform as far as accident or disease might affect them. 4th. The quantity of moisture can be regulated as necessary and made exactly uniform in all. 5th. They can be perfectly protected from all accident, as hail, wind, &c., as well as safe from the ravages of animals, birds, and insects. 6th. In harvesting, every portion of the produce can be secured without the slightest loss.'—*North British Agriculturist.*

GARDEN.

WATERING.—The *Gardener's Chronicle* says that in dry weather, when watering is important, it should be borne in mind that a good soaking once a week or so—a soaking that penetrates thoroughly, the water finding its way to every part of the root of the plant—is most beneficial, but that watering a little every day or so, giving homœopathic doses, is an operation much better left alone, for much more harm than good is likely to result from such a practice, in so much as watering in such quantity as to moisten the surface only causes growth of fibres near the top; the slight moisture not being sufficient to nourish them, but on the contrary, the young, tender growth of fibres being within reach of the burning sun, must result in exhaustion to the plant. Water, therefore should at all times be administered with a liberal hand, that it may soak and percolate thoroughly, as a long shower of rain will do, and the growth of roots will be produced and encouraged in their natural position, going deeper and deeper after the nourishment they effect, and will thus be enabled to withstand any occasional neglect.

BASSIA LATIFOLIA ROZEL.—The flowers are produced in enormous quantities in March and April, after the old leaves have fallen and before the new leaves have appeared; the crop rarely fails. The fleshy flowers fall off and cover the ground beneath the trees, and are gathered eagerly by the natives every morning during the flowering season; a single tree yields from 200 to 400lbs. weight of flowers. These flowers are stored as a staple article of food by the Bheels and other tribes, and so valuable do they consider these trees, that in time of war the threat of cutting them down generally reduces them to submission.

The flowers when dried have somewhat the odour and appearance of Sultana raisins. Lately examined by a French chemist, M. Petit, they were found to contain half their weight of sugar, and are therefore very nourishing.

In a paper recently read before the Linnæan Society by Mr. Lockwood, that gentleman stated that wild animals of many kinds troop eagerly to the mahwah trees during the season to feed on the flowers. He was therefore led to experiment upon domestic animals, and it was found that the flesh of pigs fed upon mahwah flowers in this country was much improved and acquired a delicate flavour. The animals so fed rapidly come into condition.

Again.—

The trees thrive in poor stony ground, and might therefore be cultivated on land not available for other crops. So regular is the yield of flowers, that it is said a bad mahwah harvest has never been known in India.

The flowers when dried will keep for almost any length of time and do not appear to be attacked by insects.

From the seeds an oil is extracted by the natives; it is used for lighting purposes and for soap-making. The smoke arising from the burning of the oil-cake, after expression of the oil, is said to be poisonous to rats, &c.

The mahwah tree, then, affords a means of obtaining an almost unlimited supply of food, both for man and beast, a food which will keep a great length of time in any natural temperature, and which requires no trouble to procure and no outlay in cultivation, The tree readily propagated itself by seed which, in India, is usually self-sown.

THE PROPOSED BOTANIC GARDEN AT GANESH KHIND.

GOVERNMENT RESOLUTION.

DURING August 1878 the attention of the Government of Bombay, was given to the formation of a botanic garden at Ganesh Khind, near Poona. The questions thereto pertaining were referred to a committee of specially selected and highly qualified officers; namely:—Colonel Palin, Mr. Shuttleworth, Dr. Gray, and Major Mant, R.E. Besides the matters pertaining to the Ganesh Khind Garden, the Committee's consideration was invited to the question whether Poona or Bombay should be chosen as the place for the principal botanic garden of the Bombay Presidency.

2. After much enquiry and consideration the Committee deem Poona to be, on the whole, the best place for this important institution. They submit an elaborate and interesting report, and sum up their recommendations under eighteen heads. These recommendations are all highly

approved by the Government of Bombay, with the intention of carrying them out whenever financial means shall permit. Some of them must, for want of available resources, stand over for the present. Some of them, however, may be sanctioned now, as given below, namely:—That on the present site at Ganesh Khind be established the chief botanic garden of the Bombay Presidency, and that its extent be forty acres or thereabouts. That a small branch garden, consisting of four or five acres, be established in Bombay, and that the Grant College compound be selected for this purpose. That the Superintendent be relieved of his present incongruous duties of oil-presser and drug-manufacturer, and that the oil and pharmaceutical apparatus be transferred to the Medical Stores. That part of the garden-house thus vacated be fitted up as a library and class-room; and that certain selected botanical books and diagrams be purchased. That a complete standard herbarium of the indigenous plants of Western India be formed, and that it be kept permanently in the garden house at Ganesh Khind; certain rooms therein being fitted up for the purpose. That the main scientific garden be laid out in the irregular picturesque style, with special reference to landscape effect; and that the planting of the garden be carried out gradually and without any undue haste. That the chief resources of the garden be devoted to the bringing together of the indigenous plants of Western India, and that, until this is satisfactorily accomplished, no pains be taken, except in special cases, to introduce foreign plant. That the details of planting and leaving out of the scientific garden be left in the hands of the present superintendent. That the system of interchange with other botanical gardens, of seeds and living plants, be developed to as great an extent as possible. In these and other respects the services of the present superintendent, Mr. Woodrow, will be most useful.

3. The cordial thanks of the Governor in Council are tendered to the President and Members of the Committee for the able manner—a manner which is at once learned, practical and scientific—whereby they have carried out the interesting and important task entrusted to them. His Excellency in Council trusts that their labours will bear fruit hereafter for the advancement of botanic science in Western India.

4. The acknowledgments of Government are also offered to Colonel Laughton and to Colonel Goodfellow, R.E, for the assistance rendered by them to the Committee in the preparation of surveys, plans and estimates.

MINUTE BY H. E. THE GOVERNOR.

I would invite the attention of my honourable colleagues to the status of the botanic garden on the left bank of the river Mula near Ganesh Khind. Apparently this garden must be called botanic, though its condition botanically is far from being adequately developed.

2. It appears to have been established primarily for producing medicinal plants, which would supply to the Medical Department of Government, what are termed "country medicines," that is, medicines indigenous to India. In this way it was to prove remunerative, from the value of the medical stores to be thus provided. And this object is in some degree attained.

3. But, as it was placed under the charge of a professional and scientific gardener, trained in England, Mr. Woodrow, the garden has gradually acquired a botanical character. Many useful, rare, foreign, ornamental trees, shrubs, and plants, have been planted and are being planted there year by year, which are not at all medicinal. Specimens are multiplied, and many of them are sold or offered for sale to the public. It is very creditable to Mr. Woodrow that he should have accomplished all this notwithstanding the more particular and obligatory purposes which the garden has had to fulfil.

4. The result, however, manifestly is that the garden has the appearance of being an undeveloped and poorly kept Botanic Garden—a garden which from that point of view is not worthy either of this Government or of this Presidency. The attention of every visitor must naturally be attracted to this patent circumstance rather than to the fact (ascertainable only by enquiry), that the garden is not exactly botanic, but has merely a subsidiary botanical branch attached to the main body of the affair, which is the production of indigenous medicines. This state of things cannot be satisfactory to any one concerned, and I think my colleagues will concur with me in thinking that the position is not one which we should wish to see perpetuated.

5. As we have no botanic garden in this Presidency, I suggest that we avail ourselves of this opportunity of establishing one by making this garden avowedly a botanic garden; so many plants and trees, being already available. The situation, too, as regards soil and moisture, being all that could be desired, being close to the great station and city of Poona, with all its institutions, educational and other, also being under the eye of the Government and its staff for several months of each year. It would not be necessary to incur any considerable expense at first. Once the garden was recognized as botanic, additions would be made to it from time to time. But the scientific branch of it and the cost connected therewith would have to be separated financially from the medicinal or directly remunerative branch. It is impossible that the scientific branch should pay itself: it must involve some expense, however moderate.

6. I propose that a Committee be appointed of experts to examine the garden and to propose detailed measures for forming a botanic garden here, at the least possible cost. Such Committee might consist of Dr. Wellington Gray, Secretary to the Surgeon-General (an officer well known for his attainments in botany as in other sciences), Colonel Palin, Bombay Native Infantry (also well known for his interest in and knowledge of botany), and Mr. A. T. Shuttleworth, Conservator of Forests.

7. Every assistance will doubtless be afforded to the Committee by Mr. Woodrow.

RICHARD TEMPLE.

THE COMMITTEE'S REPORT.

In accordance with Government Resolution No. 2577, dated 30th of August, 1878, the Committee named therein met for the first time at Ganesh Khind Garden, on the 8th of September, and proceeded to consider the measures necessary for forming this into a scientific botanic garden.

At their preliminary inspection the Committee were most favourably impressed with the situation and general aspect of the grounds and the character of the soil, and they then formed an opinion which, subsequent and more familiar acquaintance with the place has served to confirm, that natural advantages, which the present garden possesses, render it an eminently suitable site for the establishment of the chief botanic garden of this Presidency. The undulating surface permits of the garden being laid out with due consideration for the landscape effect, the soil is good, almost throughout, and is well adapted to the growth of the great majority of our indigenous plants; the climate is also suitable; the supply of water appears to be abundant and perennial; and, lastly, the position of the garden with respect to the city of Poona and its educational institutions is all that can be desired.

The Committee apprehend that the only objection, which can be raised against placing the chief botanic garden of Western India in the Deccan lies in the distance of the garden from the great centre, and the educational and scientific institutions of Bombay. The fact of the easy accessibility of Poona, however, will in a certain measure overcome this objection. As a rule, a large botanic garden, established for scientific objects, should be as close to the metropolis as possible, and could a suitable site be obtained for the purpose near Bombay, the greater desirability of such an arrangement, as compared with the proposed one would doubtless be admitted. But as the Committee are aware that no sufficiently large space of ground combining within itself the necessary capabilities as regards situation, soil, and water-supply exists in the vicinity of Bombay, they agree in recommending that, for reasons already stated, the principal scientific garden of Western India be established at Ganesh Khind.

It is manifest, however, that the Deccan is unsuited for the growth of certain tropical plants which require a greater degree of atmospheric moisture, and a more constant high temperature than the climate of the Deccan affords. Many of our indigenous, and a large number of naturalised plants can only be grown with difficulty above the Ghats; and in some cases hardly at all. They require the moister, warmer, and more equable climate of the Konkan. For the growth and propagation of such tropical plants, therefore, as will not flourish in the Deccan, the Committee would suggest the advisability of forming a small branch garden near Bombay. This need not consist of more than four or five acres, and the Committee are given to understand that the compound surrounding the Grant Medical College is sufficiently well adapted for the purpose they have indicated. The soil is fairly good, but in parts the ground is at so low a level as to be under water during heavy rains. Close by, however, a sufficient supply of earth exists, which could easily be utilised for raising the land to a proper level. The Grant College compound possesses one chief advantage, i.e., that it is in the immediate vicinity of the Medical School, and, were a scientific garden established here, it would be more largely used to encourage the spread of botanical knowledge than if it existed elsewhere. The Victoria Gardens were, as the Committee are informed, originally intended for a botanic garden in connection with the Victoria and Albert Museum; but for several years past they have not been conducted with any scientific object—merely as a pleasure garden. It is possible that a small portion of these gardens might be obtained for the Konkan branch garden, but for certain reasons, which need not be here specified, relating to their past and present financial position and the mode in which they are managed by the Municipality of Bombay, the Committee agree in thinking that the establishment of the branch garden in this locality would prove an unsatisfactory arrangement. The soil, too, of the Victoria Gardens is more or less saline and not well fitted for the growth of trees or shrubs. The Committee are therefore decidedly in favour of the Grant College compound being converted into the branch garden. The cost of this portion of the general scheme will doubtless form the subject of a separate investigation.

The Committee now proceed to set forth in detail the measures they would recommend for forming a botanic garden at Ganesh Khind and for keeping it up in the best and most economical manner possible. They consider that a space of forty acres, or thereabouts, out of the sixty-five which the entire garden is said to contain, is amply sufficient for the scientific garden, and this, if properly laid out and fully stocked, they think is quite as much as can be conveniently managed. The Committee propose, therefore, that that portion of the estate to the east of the nulla, and known on the plan as laid out, be the botanic garden, the remainder being reserved for the cultivation of medicinal plants and for miscellaneous agricultural purposes.

* * * * * * * *

The formation of a complete herbarium of the indigenous plants of Western India, would supply a want which has long been felt, and frequently deplored, and would prove of great scientific and practical value. A general Indian herbarium being already established at Calcutta, the Committee are of opinion that the proposed herbarium at Ganesh Khind should consist only of our indigenous plants. A separate collection of all the useful plants

cultivated in this Presidency, both indigenous and non-indigenous, should also be formed.

The Committee agree that the standard herbarium should be kept at Ganesh Khind, as the extremely moist climate of the Konkan during the rains affects dried plants most injuriously. A small branch herbarium might be established in Bombay in the Victoria and Albert Museum, and, when necessary, plants could from time to time be transferred thither from Ganesh Khind. Valuable or rare specimens should not, however, be allowed to leave the latter place, except during the dry season. The collection and preparation of a herbarium is a comparatively inexpensive process; the cost of collecting might be charged under travelling expenses, and of preparing and arranging the plants, to contingencies. Local botanists, too, and the Forest Department, would no doubt be glad to assist and contribute.

. . . .

To carry on the ordinary duties of the scientific garden a permanent establishment, in addition to the present superintendent and the office clerk, will be required. This should consist of at least thirty-five professional *malees* and a *muccadum*. For rough labour, coolies can be employed when necessary, with boys or women for weeding. A herbarium-keeper and draftsman is also essential, and a person competent for the duty can be obtained for Rs. 60 per mensem.

The annual cost of a permanent garden establishment such as that indicated above will be as follows :—

	Rs.
Superintendent at Rs. 350 per mensem	4,200
Office clerk at Rs. 25	300
Herbarium-keeper and Draftsman at Rs. 60 ...	720
Malleys and Muccadam at Rs. 300	3,600
	8,820

To the above must be added—

		Rs.
Travelling allowance	...	400
Library allowance	...	100
Herbarium	...	20
Office contingencies	...	120
Garden contingencies.	Annual Repairs	250
	Purchase and repair of implements	100
	Flower seeds	50
	Pots	40
	Packing and carriage of plants and seeds	100
	Coolie labour	7[illegible]
	Cattle food (grain)	[illegible]
	Manure ...	1[illegible]
	Miscellaneous	120
		Rs. 2,980

It will thus be seen that the estimated annual expenditure necessary for maintaining the garden in a state of proper order and efficiency amounts to Rs. 11,800, or in round numbers Rs. 12,000. This estimate the Committee have no hesitation in characterising as an exceedingly moderate one. As a set off against it, moreover, there is little doubt that by a judicious course of management a very considerable income will eventually be derived from the sale of plants, seeds, miscellaneous garden produce, and herbarium specimens. The present receipts from the first three of these sources amount to about Rs. 1,500 annually.

The Committee having now considered and discussed fully the steps which in their opinion are necessary to the formation of a scientific botanic garden at Ganesh Khind, it will be convenient to set forth here a summary of their recommendations :—1. That on the present site at Ganesh Khind be established the chief botanic garden of the Bombay Presidency, and that its extent be forty acres or thereabouts. 2. That a small branch garden, consisting of four or five acres, be established in Bombay, and that the Grant College compound be selected for this purpose. 3. That all the main roads of the Ganesh Khind Garden, as shown in the plan, be permanently constructed by the Public Works Department at as early a date as practicable. 4. That a piece of ornamental water be formed; this work to be also undertaken by the Public Works Department. 5. That an orchid and fern-house, a summer house, a cattle and implement shed, and a potting shed be erected, and that the existing plant-house be reconstructed; all being done by the Public Works Department. 6. That the water-supply system of the garden be of iron piping, with masonry tanks or hydrants at intervals. 7. That the superintendent be relieved of his present incongruous duties of oil-presser, and drug-manufacturer, and that the oil and pharmaceutical apparatus be transferred to the Medical Stores. 8. That part of the garden-house thus vacated be fitted up as a library and class room, and that certain selected botanical books and diagrams be purchased. 9. That a complete standard herbarium of the indigenous plants of Western India be formed, and that it be kept permanently in the garden house at Ganesh Khind, certain rooms therein being fitted up for the purpose. 10. That the main scientific garden be laid out in the irregular picturesque style, with special reference to landscape effect; and that the planting of the garden be carried out gradually, and without any undue haste. 11. That the chief resources of the garden be devoted to the bringing together of the indigenous plants of Western India, and that until this is satisfactorily accomplished, no pains be taken, except in special cases, to introduce foreign plants. 12. That a small class garden, for practical instruction in elementary systematic botany, be established. 13. That the [illegible] of the planting and laying out of the scientific garden be left in the hands of the present superintendent. 14. That for the purpose of collecting plants and specimens, the garden superintendent be permitted to travel through certain parts of the Presidency each year. 15. That the system of interchange with other botanical gardens of seeds and living plants, be developed to as great an extent as possible. 16. That a permanent establishment, consisting of a superintendent, an office clerk, a herbarium-keeper and draftsman, thirty-five *mallees*, and a *muccadum*, be entertained for carrying on the ordinary duties of the garden. 17. That an extraordinary expenditure of Rs. 22,037 be sanctioned for the purpose of constructing roads and foot-paths, excavating a pond, erecting houses and sheds providing iron piping, &c., &c., for water-supply, fitting up rooms for the herbarium, library and class-room and for the purchase of botanical books and diagrams. 18. That a recurring annual grant of at least Rs. 12,000 be provided for the maintenance of garden, herbarium and library.

The Committee desire to acknowledge the aid they have received from Colonel Laughton in the preparation of a plan of the garden and from Colonel Goodfellow, R E., in furnishing the annexed estimate. They have also to thank Mr. Woodrow, the Superintendent, for his cordial and intelligent co-operation and assistance.

In conclusion, the Committee trust that the proposals they have adopted, and which, after careful consideration, they agree in recommending as the best fitted to attain the object in view, will meet with the approval of Government, and that the result will be creation of a scientific botanic garden which shall prove second to none in this country.

CHARLES PALIN, President.
ALLEN SHUTTLEWORTH, Conservator of Forests, N. D.
W. GRAY, Surgeon-Major,
CHARLES MANT, Major, R. E.
} Members.

FORESTRY.

THE EUCALYPTUS IN ALGERIA.—The establishment of plantations of *Eucalyptus* in certain Algerian plains, hitherto innocent of trees, has been followed by unforeseen consequences of vital importance to many of the colonists. For, besides their vaunted beneficial action in purifying the air and moderating the heat, these plantations have had the further effect of attracting countless myriads of sparrows, whose depredations have reached a point of very grave severity.

THE following is from the Forest Reserve Commission's Report on the Nilgiri District to the Madras Government.—

"Without considering the possible effect of trees on rainfall and climate, we have considered as beyond dispute the facts that woodlands exercise a most beneficial effect in the retention of water and the regulation of the supply, and that any extensive denudation near the sources or along the courses of streams must of necessity be followed by destructive floods and equally fatal droughts."

A MONTH or two before his sad end, Mr. Nepean found a species of *Vanilla* vine growing in the Upper Thoungyeen forests. British Burma possesses two varieties of this plant, one with large and the other with small leaf. What Mr. Nepean saw was of the former kind, slightly resembling the true *Vanilla* which has a very narrow and somewhat short leaf and short interpetiolary joints. The specimen referred to was both in fruit and flower, a very rare occurrence as it needs manipulation to fertilize the stigma.

Mr. Hardinge, Secretary to the local Agri-Horticultural Society, found the common *Vanilla* abundant in the Arakan Hills.

SOME fine plants sent from the Upper Thoungyeen forests, to the garden of the Agri-Horticultural Society here, are said to be doing very well. The experiment of growing them amongst teak has been commenced in the East Salween Forest sub-division.

IN the *Journal of Botany* for November 1878, a new oak from Assam is described by Dr. Hance under the name of *Quercus Kurzii*. Dr. Hance says :—

At the close of the summer of 1877, just before leaving Calcutta for Penang, where he was prematurely cut off in the prime of life, that indefatigable and conscientious botanist, the late Mr. Sulpiz Kurz, sent me a few Indian oaks for examination. The only novelty in the very small collection was a curious species, ticketed in pencil, in Mr. Kurz's autograph, "*Castanea semicristata*, Kurz."

THE DIFFICULTIES OF TREE PLANTING.

"FLOREAT ARBOR" writes:—The short but pertinent article in the *Madras Times* of the 23rd ultimo, headed as above, has set me thinking. How few men there are now-a-days who care for tree-planting in any way! But how many there are whose proclivities run directly towards destroying and cutting down trees! Officials in charge of roads, and Municipal authorities too often exhibit great apathy towards the planting and maintenance of trees, and the tenant of a house having a well-planted compound will too often cut down valuable or useful fruit and shade trees just 'to let in the air' or to 'expand the view,' or will quietly sit down and see the servants destroying the trees in their search after fruit or firewood, or witness, with unconcern, the trees and shrubs ruthlessly and needlessly destroyed, by the wanton admission, or unauthorized intrusion, of cattle or goats. The native, the ryot, the herdsman, and the cooly are in most cases perfectly callous as to the fate of trees, young or old, so long as his cows, buffaloes and goats get their daily quantum of food orn from the branches, and also provided that he himself is well supplied with firewood *gratis*, to say nothing of the injury to trees caused by the pernicious habit the ryots have of annually stripping the trees of their living branches and leaves for the sake of manuring their paddy-fields! Goats, indeed, are too often the curse of this country as regards the vegetation they destroy, especially in and about our towns, villages and cantonments. They will attack, tearing and biting, anything green they may come across, if they will not eat everything, even the "milk hedge." Whatever they bite either dies or flags at once. We are told that after the introduction of goats into St. Helena they soon completely exterminated a valuable species of tree by browsing on it, and, no doubt, they would soon convert this 'happy smiling land' (botanically) into a howling "wilderness" were they only a little more numerous and a little more uncontrolled. As instances of successful planting, look at the old topes—now alas but few all over the country. Look at the old roads alongside, or crossing, the line of railway, very often so carefully lined with trees, green trees on each side. Look at the green topes, and shady roads in Mysore and look at the Cubbon Park in Bangalore. But, on the other hand, look at the failure of the planting along the "Ride" at Bangalore and some of the roads and open places that were so carefully attended to during the time of Colonel Mesham, the D. A. Q. M. G. there for so long. Of late, their fences have been broken down, and they have been eaten up, or torn to pieces by goats, buffaloes, &c., whether 'by your leave' or not is unknown. Want of water, too, is another cause of failure. Perhaps the 'famine time' may be somewhat to blame, but it is now time to take the matter in hand once more. Bellary, also, which has a few years ago been pretty successfully planted (in the cantonment) under the Municipality and A.Q.M.G. has suffered very much from the famine (*i. e.* from the drought) and scarcity of forage,—many, very many. trees and shrubs having quite disappeared. The compounds are for the most part 'all open,' and cows, buffaloes, and goats roam everywhere, day and night, without saying "by your leave," and work their wicked will.

The military regulations regarding cantonments say that "Trees should be planted about cantonments on the sides of the roads and in the vicinity of the barracks, to afford shade" * * * "Trees already planted are to be carefully looked after. The expense incurred in carrying out these measures should be met out of the cantonment funds." This is a very excellent order and should be acted up to both in the letter and the spirit no doubt, whenever there is money in hand. Many of our stations have been much 'improved' of late years. But it is time that serious attention was now paid to the planting of fuel reserves in the neighbourhood of our towns, cantonments and villages. The area of the circle cleared by the wood-cutter is increasing every year, the price of firewood increasing in consequence, and yet no attempts at replanting are made, nor have the jungles any chance of recovering themselves, the young shoots of the sprouting stumps and young seedlings being constantly eaten down by roaming cattle and goats, or destroyed by fire. It is now time to limit, at the least, cutting of firewood to a fixed distance beyond a certain radius, say seven miles from our large towns and cantonments. This would give some small chance of recovery. The Babool tree, *Acacia Arabica* (The *Gum Arabic* tree) and its relative *A. Vera* (the *true* acacia or *gum acacia* tree) which are so hard, and grow so easily everywhere might be largely disseminated by seeds from the Ceded and Southern Districts. But, perhaps, better than all others, as a fuel and generally useful wood, is that of the casuarina—now so widely spread and well known everywhere, not only as a good wood for fuel, but also as a very superior wood for general purposes, house-building, &c. This wood has been proved to stand successfully a more severe cross strain than any other wood, I believe (*see reports of Juries of Great Exhibition* of '51), whilst at the same time it is more elastic than teak, and quite as impervious to the attacks of white ants, &c., when properly seasoned. Its cost is as nothing when compared to that of teak, angell wood, &c. The jak and angell wood trees should also be more extensively planted than they are, as also tamarind (a slow grower) and jungle almond (turmanilia). But careful planting at first requires always some expenditure of time, and too often a certain expenditure of money, and afterwards a positively certain expenditure of money in watering and guarding the young trees,—expenditures which, at present, the Government is unable, and individuals have been unwilling, to incur on a large scale. The well-to-do native landholders and merchants might do a great deal in this respect if they would, and this would be just as good and proper an exercise of "charity" as feeding Brahmins and dosing the ants on the roadside with sugar.

TREE PLANTING IN AMERICA.

THE Americans are wiser than we are in the matter of tree planting, though the need for verdure is not so great in "the States" as it is in Southern India. Could not the Government of Madras take some active steps towards the reboisement of the country after the manner described in a paragraph we shall immediately quote? We think a similar course might be adopted in this country, if anybody was sufficiently in earnest to care about the matter. A correspondent of *The Times* has been visiting the State of Nebraska after an interval of ten years. This is what he says about the planting of trees and the manner in which such planting is fostered by the "free" Government of the United States:—"The sight of a tree is no longer rare or noteworthy. The prospect is now varied and rendered attractive by numbers of snug farm houses and by frequent clumps of trees. A farmer's first care after preparing land for the plough, is to plant trees on his homestead; they grow rapidly, and they serve the purpose both of supplying the timber which is much needed, and also the protection from the winds which is specially desirable. Even if self-interest did not prompt the farmer to do in Nebraska what Scott did with such good effect around Abbotsford, he has another inducement to help in covering the land with wood. A State law gives special encouragement to timber growing, taxes being remitted in proportion to the number of acres upon which trees have been planted. In proof of the rapidity with which the monotonous prairie can be diversified with trees, I may state that here the useful cotton-wood tree attains a diameter of 20 inches within the space of 12 years, that within three years after planting cotton-wood, maple, ash, and walnut trees become large enough to supply fuel, and that they furnish all the wood for use on a farm within five years after planting. Nebraska has the credit of being the first prairie State which has passed a wise law on this important subject." Our Government professes to be "paternal" we wish it would display a little paternal care towards a matter of so much importance as is the re-covering of the country with trees.

TREE-PLANTING IN SOUTHERN INDIA.

A VALUED and experienced contributor writes:—

"I read a very sensible article in the *Madras Times* to hand this morning regarding tree planting; it is one which will benefit the country at large, but to which Government give little heed and less encouragement. I can speak from experience in the Mysore province that there are large tracts of land which might be well utilised for growing trees, land which, under ordinary conditions will never yield a pie of revenue, and which native ryots will never dream of taking up for grain-cultivation, but in the hands of enterprising Europeans who would take trouble and lay out capital, might be brought into use as fuel preserves.

"But what encouragement is held out to such individuals? None. On the land being surveyed and assessed, if an application is made for a vacant site, Government insists on the full assessment being paid, and no reduction whatever is made. Some years ago, I believe in Mr. Bowring's time, there were some rules drawn up, under which parties might apply for waste land to plant out with fuel trees. Such lands were given free of assessment for a period of ten or fifteen years, subject to conditions which allowed Government to resume the lands if required for public purposes, of course compensating the grower, and, further, ascertain what proportion of area was to be planted yearly. The rules, however, did not *draw*, as the officials placed a good many obstacles in the way, giving all kinds of trouble and petty annoyances; and, finally the Government rules have been allowed to become a dead letter and were then cancelled.

"Now I (and several others) who take a look well a-head know that *fuel* will always pay so long as there are railways in India, and I should like to go into the planting speculation largely, but how can I afford to pay, say Rs. 300 for 200 acres for five or six years, without getting a return. A ryot takes up land and cultivates; he has a return *at once*, *i.e.*, in the course of the year, and he is enabled to pay assessment; but with tree-planting it is different. There would be no return for at least five years, and, therefore, the next three or four afterwards that came in would only pay working expenses.

"Now, if Government would give land free for ten years, it would be some encouragement, I don't ask that Government should give *good land*, but there are hundreds of acres of waste, which

grow nought but coarse grass and broom straws, that could be well utilised. Then there are the beds of old breached tanks; some I know are cultivated occasionally, but that is only in exceptional instances, and probably occurs when the tank is situated adjacent to a large and populous village, but for every one such there are ten that are unproductive of a cent to Government. Why should not these be planted out?

"Just instance what was done in former days. If a man planted a couple of hundred trees as avenue trees along a road and round them, he was rewarded with lands free of tax, which, in after years, as a jaghire or jodi, passed into his family as valuable property. Avenue planting was good for travellers, and in some parts yielded a small revenue from fruit, but there was better benefit to the country. Now tree-planting, as you suggest, would be useful, and yet a man is not encouraged to do this. Why? Government ought to take the matter up and act in a more liberal spirit. It may be said that Government, having a large Forest Department to conserve and plant trees, do not care to encourage private individuals. This is moonshine. The Forest Department has done but little more than adopt steps to take care of *trees when they are found growing natural, i e.*, in large forests, on hills, &c., but their efforts to plant out new plantations have been very poor compared with their outlay. But the Forest Department would not be interfered, with in any way, and the efforts of private individuals would be turned to planting tracts in *maidan* places where the Forest Department would not put down a sapling.

"I may add here that a good deal of jealousy and obstructiveness to private enterprise is shewn by the Forest Department, inasmuch as, when a person applied (formerly) for a piece of land under the Forest rules, it being referred to the Forest Department, was at once reported on as being 'necessary for the operations of the Department.' Of course, this was an excuse not to give it, and it is superfluous to add that many sites so applied for have never to this day been utilised."

BRITISH BURMA FOREST REPORTS FOR THE YEAR 1877-78.

THERE has been, again, unusual delay in the submission of these reports in their completed state, owing to repeated references between the Department and the Comptroller-General, Calcutta, in regard to the financial results of the year. The report for the Tenasserim circle was received by the Chief Commissioner in manuscript as far back as 10th July, but on the 31st of that month, it was intimated that alterations in certain of the figured statements would probably have to be made. In the case of the Pegu circle, the financial statement (form 51) was received by the Additional Conservator on 26th September from the Comptroller General, and the report reached the Secretariat on 12th October.

No legislative measures were carried into effect during the year. The question of having a new Forest Act for British Burma was under consideration, as was also that of revised rules for the control of rivers and timber in transit and the management of timber-revenue stations, but no decision had been arrived at when the year closed.

In the Tenasserim circle, the progress made with reserves has not been great, and not such as might have been looked for from the report of the year previous. In the report for 1876-77, it was stated that proposals had been submitted for reserving 47 square miles, and were about to be submitted for the reservation of an area of about 170 square miles, the necessary surveys and maps having been completed. At the close of 1877-78, however, the additional area of reserves amounted only to 68 square miles. The work as regards the larger area has apparently been done over again by the Forest Settlement Department, which commenced work for the first time in the Tenasserim circle, and submitted proposals for fresh reserves containing an area of about 170 square miles. The preliminary survey and selection of tracts suitable for reserves was unfortunately delayed by the illness of the officer deputed for this duty, and an area of only about 55 square miles has been selected.

For the Pegu circle, the figures relating to sanctioned reserves, as given in the body of the report, differ considerably from those which appear in statement No. 45. In the report, the Conservator has given not only the results of the work done during the year, but also of that which has been done since the close of the year and up to what he calls the end of the season. The report however is for the official year, and should relate only to work done during that period. It only tends to confusion to mix up the figures of work done since the close of the year, which figures will again appear in the next year's report. The area of reserves added during the year amounts to 239 square miles, while it has been necessary to exclude an area of 296 square miles from that hitherto shewn under the head of "State reserves," owing to the tracts in question having been taken up under rules, which have never been sanctioned, so that the net result during the year gives a decrease of 58 square miles. The area of proposed reserves awaiting sanction at the close of the year was no less than 863 square miles. It is open to doubt whether the reservation of these large tracts does not in some cases press with some hardship on the Karens and the sparse population in the forests, notwithstanding the careful inquiry usually made into their claims and rights.

In three reserves of the Tenasserim circle—namely, Sinzway, Oankangyee, and Dalee—the propagation of teak by the Karens under the *toungya* system resulted in the cultivation of 84 acres covered with 26,465 plants, the average number of plants per acre varying, according to the locality, from 287 to 335. The experiment made by Mr. Bingham in the previous year, of sowing teak seed in lines 20 feet apart within the Sinzway reserve, was thwarted by the scarcity of labour at the proper time for weeding the undergrowth, and by the fickle disposition of the Karens. Operations were however renewed in the year under report, measures having been adopted to have labourers on the spot when they were needed, and it is expected that a satisfactory growth of healthy teak plants will be the result. Considerable progress was also made in laying down teak seed in the *toungya* clearances in the Tharrawaddy reserves, 203 acres having been sown by the Karen cultivator during the year, at a cost to the Department of Rs. 690, or Rs. 3-6 an acre, resulting in the appearance of some 77,000 healthy plants. Eight acres were sown in the same way in the Yaynay reserve of the Sittang division, at a cost of Rs. 102, and the ground is now well covered with young plants. This system is capable of very extensive development, and more scope will be afforded for it when the prohibition against the girdling of mature teak trees has been removed, and when the fire protection measures have had time to be well tested in the younger reserves. Re-production of teak by the process of "dibbling in" was again freely tried in fire-traced reserves, some 2,000 acres having been so treated in the Mokkha Beeling and Kangyee reserves of the Tharrawaddy division during the year; while the area that failed in 1876-77 was re-sown. A satisfactory growth of plants has resulted, but the process is costly, the outlay having been for the year Rs. 3,890, exclusive altogether of the expenditure in weeding and keeping down the undergrowth which springs up so rapidly as to choke the young plants. If more confidence could be placed in the real desire of the Karen cultivators to prevent fires in their grounds, the *toungya* system will very probably be found, as Mr. Ribbentrop observes, to be preferable to the other on every score, provided labourers can be secured in sufficient numbers to carry it out.

There are in the Tenasserim circle three small teak plantations, formed in 1856, and aggregating 17 acres. These have cost from first to last Rs. 22,291, but, beyond a remark that one of them (Thinganee noung) "had to be abandoned" during the year "for want of labour and owing to sickness among coolies," no allusion is made to them in Major Seaton's report, nor was any new plantation work carried out. The plantations in Pegu now aggregate 3,322 acres, the principal ones being those at Kyetpyoogan and Magayee in the Rangoon district, the enormous cost of both of which and the best means of redeeming at least a part of it are now under discussion. To the latter, 273 acres of teak cultivation were added during the year under notice, and 63½ acres cleared for cultivation in 1878-79, the entire outlay for the year being Rs 18,373. This brings up the area of the plantation to 1,306 acres, and the expenditure from first to last to Rs. 93,947. An unsatisfactory feature in the case of both plantations is their liability to injure by fire year after year. In the case of Magayee, however, which now forms a part of the newly-sanctioned Magayee reserve of 20 square miles, it is natural to look in future for greater immunity from this danger, provided a fire-trace of liberal breadth is formed around the boundary of the reserve.

In the Tenasserim circle, no minor cultivation of any kind was attempted, and the report is silent as to the progress made in that reported on in the previous year; but at Magayee, plants of *Ficus elastica* were planted out over an area of 87 acres. A portion of these however and also nearly one-third of the plants of *Chironessia esculenta* laid down in previous years perished in the third outbreak of fire in the plantation towards the end of the dry season. In the cinchona plantation at Thandoungyee, the expenditure is certainly not compensated for by the results attained. This had already attracted the attention of the Government of India, but it will now be reduced by Rs. 1,200 a year, as five Karen apprentices, who received Rs. 20 a month each, have left the plantation, where there was insufficient occupation for them, and as they were unwilling, it is said, to work in other parts of the district. The cinchona seedlings, put down in previous years, of the *Condaminea* variety, have gradually died off, and very few of them now remain. A quantity of bark was gathered from decaying and unhealthy looking trees during the year, and made over to the medical authorities for use in hospitals, but no report on its medicinal value has yet been received. A large number of seedlings of the *Succirubra* variety, and some of *Calisaya*, were planted during the year.

None of these now exist either in Pegu or Tenasserim. In the latter circle, however, a number of 30 years' permits (21) were granted in 1865, authorizing the holders of them to cut teak in the Attaran forests. They are restricted, however, to trees girthing 7½ feet at 6 feet from the ground and have to pay duty in the ordinary way on what they remove. In 1896, the rights in these forests will revert absolutely to Government. One lease also exists in the Attaran district, which was granted in 1829 for 99 years.

These, under the orders of the Government of India, continued in abeyance throughout the year in both circles, and the entire energies of the Forest Staff were concentrated on the selection and settlement of reserves.

Several practical difficulties were encountered in connection with the working of notification Nos. 33 and 81 of 8th March 1876,—some Civil Officers putting too liberal an interpretation on the scope and applicability of free permits. To correct any misapprehension on this point, revised rules were issued in January 1878, restricting the grant of free permits to persons living within five miles of the spot where the timber was growing,

and that use for their domestic or agricultural requirements only. There can be little doubt that previously much timber, really wanted for purposes of trade, had been obtained under the cloak of free permits by many persons living at long distances from the forests. Free permits of the reserved sorts of timber continued, under the revised rules, to be made for building Burmese monastic schools, rest-houses, bridges, &c. It was considered advisable in August 1877 to withdraw the right of Civil Officers to grant trade permits for the cutting of padouk. There is a very limited growth of this timber, its reputation as a durable and valuable wood is increasing, and it was thought better to leave its extraction (for the present at all events) under the control of the Forest Department. One result of this restriction will doubtless be to lead the people to the use of many varieties of unreserved timber hitherto untried, but probably equally suitable for many of their wants. Much experience has now been gained of the working of the notifications 33 and 34, of 8th March 1876, and it will be possible, in re-casting the rules, to make valuable use of that experience in so far as it will help to settle on a just and satisfactory footing the ancient forest privileges of the communities affected by them.

In the Tenasserim circle, only 174 tons of padouk, thitka, and pine were extracted by Government agency,—the dull condition of the market, added to the stock remaining over from the previous year, giving little inducement to bring out a large quantity. At Tavoy, 863 pynkadoe sleepers were ready for transport to Moulmein at the close of the year, and contracts were entered into for 6,000 more at Tavoy, and for 800 of various kinds at Mergui. In the Pegu circle 2,918 tons of various woods were extracted by the Department during the year.

Salving operations were not so successful on the Salween as in the previous year, only 4,881 logs of teak having been salved, as compared with 6,715 in 1876-77. This was due to the unusually flooded state of the river, which rendered the work one of much danger, a good deal of timber drifting out to sea. In the Pegu circle, 9,186 logs were salved, 7,980 of them being, however, delivered to claimants afterwards, compared with 1,815 restored on the Tenasserim side; but the aggregate result of the operations in both circles would appear to have been Rs. 68,950 in the form of receipts from this source, against an expenditure of Rs 40,716.

There was a net increase of 40,930 logs over the quantity imported during the previous year, and of 22,847 logs over the importations of 1875-76. In the case of the Salween, the increase is attributed to greater activity in working the Karennee and other forests. It is noticed that the timber of this year is much superior in quality to that imported in the years immediately preceding, and, although the tracts in the more immediate vicinity of the rivers and streams have been well nigh exhausted, there are understood to be still considerable areas of fine forest country further inland, from which however the removal of timber will be attended with difficulty. No reason is assigned for the large increase by the Irrawaddy. It was caused to a great extent, doubtless, by the highly-flooded state of the country, and the consequent unusual facilities for floating timber down. The quantity of teak from British forests entered for duty at Kadoe during the year was again, as might have been looked for, very small, although the floating facilities of the season were unusually favourable. Better results will not be secured until girdling work is again permitted.

Enquiries were made early in the year on behalf of the Admiralty, as to whether a further supply of selected teak timber could be provided, similar to that sent home by the *Dreadnought* in the previous year. In the meantime, however, this vessel's cargo, although selected with much care and trouble, had not on examination quite satisfied the expectations of the dockyard authorities, and further shipments were countermanded. Under present circumstances, it would probably be found impossible to pick out even a small quantity of timber equal to Admiralty requirements.

With the exception of one officer whose ill-health was due in a greater measure, perhaps, to a prolonged and unbroken residence in the country than to any immediate effects of exposure in the forests, the controlling staff throughout both circles escaped serious sickness. As the Additional Conservator points out, the liberal travelling allowances and the youth of so large a proportion of the present staff officers has much to do with this result.

The Planters' Gazette.

TEA.

THE following, from the review in the *Ceylon Times* of the experimental gardens at Peradenya, would not seem to speak well for the chances of tea-planting in Ceylon. "We noticed plants of the China and Assam varieties. The Chinese are eighteen months old, but very stunted; those from Assam are in a better condition, but still hardly in a satisfactory state, considering their age."

TEA-SORTING, FINAL FIRING AND PACKING IN COLOMBO: ITS ADVANTAGES AND DISADVANTAGES.

(*By a former Assam Tea Planter.*)

HAVING read a few days back of the Ceylon Company, Limited, having opened an establishment in Colombo for finally preparing teas for shipment to the English market or elsewhere, I will here make a few remarks on the subject, and point out the advantages and disadvantages of such an establishment. Of course I do not push my opinion as granted, but I have viewed the different sides of the question, and say that such an establishment takes a great deal of responsibility on itself and great credit is due to the Ceylon Company for undertaking to carry out its arrangements.

Before going further into the matter, I must necessarily give a short sketch of how teas are manipulated in order to arrive at the advantages and disadvantages of forwarding teas to such an establishment. In the first instance, as most people are aware, the leaf or flushes are gathered, by women, girls and boys, brought in once or twice a day as the weather stands; on a very hot day I should say twice and on a cool one once would be sufficient: the reason being, not to allow the leaf in the baskets to ferment, as it would on a hot day. When the leaf is gathered, it is taken to a large, cool airy room where it is spread out thinly and allowed through the night to wither. This is one of the most important processes in tea-making, and a great deal of care must be taken that before leaf is rolled it is properly ready to bear the force of rolling; any leaf taken off and rolled immediately will necessarily crack and break up; but by being exposed to air for a certain time will soften and give to pressure; in other words this is called *weathering*, and on this depends the qualities of the teas. When the leaf will give or feel soft on pressure it is ready for what is called a first rolling before it goes through any firing. There are times at which the withering takes longer than at others; during the rains, and when the weather is very cold, the leaf will remain as when picked fresh, and if kept too long before withering will give sour teas (but will not ferment as some people suppose), and to avoid this delay in withering you may pass the leaf over a charcoal fire or through your pan heated to a gentle heat. I have adopted the latter process and found it answer quicker. Here again, when you have to give the leaf an artificial withering, the rolled leaf takes a much longer time to ferment, which is the next thing that it has to undergo, and not less important matter in the manipulation. There is no fixed time to allow for fermenting; your own practical experience must teach you. When you think your leaf is sufficiently and properly fermented the leaf will turn a rich orange or rather copper colour; too deep a tone will give you red leaf, which has more or less to be picked out in sorting; although you may have picked nothing but fine leaf in the gathering, yet it will have to be classified as inferior if over fermented—you either pan your leaf before a second rolling or not, but I most certainly hold to panning to give a fine quality and strength. (You may depend that most of the inferior teas that are sent home and are complained of, were obtained by not panning the fermented leaf; the leaf will not roll so easily.) After this second rolling is over, it gets a third or final rolling, and then it is ready for firing over charcoal fires in what is called a *dhôle* or drum—made of bamboo, or as in Ceylon, cane. It does not do to over-fire your teas the first day, as you are apt to burn your tips or flowery Pekoe away, but give it a gentle firing, and next day give it a stronger one, and put into your bin or large tin or lead lined air-tight box. Your teas are now ready for sieving and sorting for packing—sieves are of different numbers, running from 6 to about 16. For the teas usually prepared on an estate Nos. 10 and upwards are sufficient, as the meshes are close, and teas passing through fine. All remaining in No. 10 may be sorted and packed as Pekoe Souchong; and that which passes through as Pekoe and fine Pekoe or Flowery Pekoe, which does not require sorting. (In a large establishment such as is opened by the Ceylon Company, Limited, a sieving machine, known in Assam as the "Taxidianimeter" patented by Messrs. Parry, Smith & Co., and to be had in Calcutta, is what is required, and will save a very large force of sorters and sievers—purchasing sets of sieves costs almost as much as getting one of these, and there is less trouble than in arranging sieves—one man feeds and another simply turns the handle, when different quality of teas are thrown out on different sides). The teas when sorted and seived are now ready for packing, and before doing so you give your teas a last or final firing, and then put into whatever size boxes you intend, which are previously lead-lined, and packed for shipment.

Having gone hurriedly through the manipulation, the first thing that strikes one is at what stage during the manipulation will the teas bear safe carriage to Colombo from, say, 100 miles, (most of the tea estates in Ceylon are a day's journey from any railway! I think—but am open to correction). We take the first stage after picking: the leaf will not

bear being heavily packed and kept in bulk long, but will ferment or heat, so this is out of the question. The next is during or after fermentation. You would have to do so immediately after the first rolling, and let it ferment during transmission. Here you run the risk of over-fermenting, during any delay which may occur to rail or coolie:—this won't do! Of course it cannot be done after fermentation and before drum firing. After it has received the first or loose firing you may do so; but would have to send your teas in a very air-tight bin or box, as at this or any after stage the teas will sour, and where are you then? The only stage that I can see is just before final firing for shipment home and yet again an air-tight bin would be required, tin or lead lined, screwed down, and opened in Colombo, to be immediately thrown into a bin ready to receive it there; ah! and it runs risks even now. Not that I say every care will not be given to it by the Ceylon Company's manager, and employeés; but where such a delicate thing, as tea is concerned, it requires immediate supervision and attention, and in any delay you risk the value of your teas. In an establishment like a packing and sorting house, you would require, where fifty different estates send down their teas, fifty different bins, and a like establishment of sievers and sorters, as you are apt to get your teas mixed up with those of other estates without there is a very careful and constant supervision in the different departments. It is quite a different affair in China, where the cultivators are more or less ryots and where they sell their teas to the house intending to finally pack it, but not in a single instance do they lose sight of it for final packing, &c., at their own risk by others. In China, a cultivator in a very few instances has not more than four or five acres of tea, and what is made of these few acres is purchased by merchants and others, who then pack or run every risk themselves. I will now go on to the advantages. You have first that of not having a fixed establishment on your estate for soldering, carpentering, sawing, sorting, &c., and you give your tea over to a house that sees that it is shipped carefully away, and not thrown helter skelter into a warehouse or broker's store to be injured in every possible way before shipment.

Taking both sides of the question into careful consideration, I should think the advantages that would be gained by sending your teas down for *more* than mere *final firing, packing and shipping home* are few and far between. I hope I may be wrong, and would *indeed* like to see this enterprising and successful Co. gain wider-spread name than it already has done with the new year, and many happy returns of it by a well-wisher and

TEA PLANTER.

Matale East, 31st Dec. 1878.

We give prominence at this stage in the tea enterprise in Ceylon to the above paper by one whose experience in connection with tea estates and tea factories in Assam qualifies him to speak with some authority. It will be seen that, while very fairly setting forth the advantages and disadvantages of such an establishment as the Ceylon Company, Limited, have founded in Colombo, he rather hopes for than expects unqualified success. In a private note he refers to the failure of a somewhat similar establishment in one of the Indian tea districts, but the circumstances were probably different. Readers interested will form their own opinions, and time will settle the question. We have always had a leaning to the idea of central factories. It is true that tea houses on a modest scale can be erected on estates at a cheap rate; but after a time the difficulty will be in connection with timber for charcoal and boxes. It is of great importance that the boxes in which tea is packed should be as much as possible of uniform weight with reference to questions of tare in the home market, and it is obvious that a firm or company doing business on a large scale would be at an advantage in this respect. Materials for boxes of a suitable timber, well seasoned, could be supplied cheaply in large quantities. So, as regards charcoal, should further experience prove that charcoal heat and charcoal fumes are absolutely necessary for the perfect preparation of tea. The question has been repeatedly raised and those who have read Colonel Money's Prize Essay know that he, in the most iconoclastic spirit, disposes one after another of all the mysteries of tea-roasting by a succession of pans. He finally dispenses with all appliances for firing tea except trays of perforated cloth or metal. Mr. Brace, who contributed an essay to the *Observer*, recommends trays in tiers of not more than three, the under one to be after a time carefully and cautiously shifted to the top. Great care is requisite to prevent any tea leaves falling into the fire and producing smoke. If the muslin netting tea-cloth (Messrs. Walker & Co., have some for sale), or the wire trays, get burnt or heated, damage to the tea leaf will accrue. Even if pans are used, and our correspondent takes their use for granted, there is the possibility of over-roasting, if the pans get over-heated, or are not kept constantly in motion, to facilitate which they are hung loosely. In our own experience, excellent tea has been prepared by such simple means as a cylinder of closely woven matting or of sheet iron, about 3 to 4 feet high, placed over a clear charcoal fire, and the tea leaves, after proper rolling and fermenting, placed over the top of the cylinder, in a tray composed simply of muslin net fixed to a hoop of bamboo. With such simple apparatus excellent and well-dried tea can be prepared, but no doubt ordinary net has the disadvantage of rapidly charring under the influence of the heat which dries the tea. With specially prepared open cloth, with pierced metal, or with wires, there is, of course, slower tendency to destruction, to delay which and to prevent the burning of the tea leaves, untiring care is necessary. There can, indeed, be no question that the preparation of tea requires much more of minute and personal attention than is the case with coffee: the main agent in the one case being fire; in the other water. A division of labour, if it could be successfully effected, is therefore, no doubt, desirable. There is, too, the fact as regards tea, that, instead of a pressure at crop time for a few months, "flushes" of tea will require to be gathered and prepared over a considerable portion of the year. In Northern India the dormant months extend from November to March, but in a country like Ceylon, we suspect there will be little appreciable cession of flushes, except when a chill wind is accompanied by constant drizzling rain so as to counteract the influence of genial sun heat. In the case within our personal experience to which we have been referring, not only are pans dispensed with in the firing process, but there is no sieving or sorting of the tea subsequently. The tea is one kind, a very superior Pekoe Souchong, every single tip as well as every tender leaf being present. In the case of high-grown tea, this surely ought to be enough, and the product ought to command a market, unmixed and on its own merits. To tea drinkers in England it would be cheap at 4*s*. per lb. But the brokers stop the way of any thing so simple. Mr. Burrell would be the man to carry out the idea. Meantime may we ask gentlemen of Indian and local experience if they consider copper pans absolutely necessary for the thorough firing of tea, and, if so, why? Also whether the use of charcoal or other artificial heat cannot be wisely and advantageously economized by the utilization of the sun's rays, in their ordinary condition or concentrated by mirrors? We know that many Indian planters prepare teas largely by spreading the rolled and fermented leaf in the sun, on iron plates or other suitable material. Our correspondent gives an interesting account of the tea-sorting machine. More important still is the rolling machine by which an enormous amount of hand labour is saved, though not entirely dispensed with. Then our good friend Mr. Baker has patented an apparatus for driving excess of moisture out of tea leaves in wet weather—the moisture being expelled by rapid revolution, we believe. Labour is so scarce and difficult in Assam that labour-saving appliances are already largely in use. Here it is only when very large quantities are produced that we need think of machinery. No machine is ever likely to supersede the delicate hands of women and children for the plucking of the flushes. The mode of plucking described in the *Produce Markets' Review*, includes, the taking away of at least a portion of the fourth leaf down from the tip. Surely it would be better for the quality of the tea and for the healthy aftergrowth of the plant, if only the tip, two leaves below it, and half the third leaf, were taken away? What do experts say? On the property in which we are interested, we should never think of allowing four leaves, in addition to those undeveloped in the "tip" to be taken away. Nature must certainly and rapidly resent so heroic an outrage on her laws. But, however gathered and however roasted, clear it is that if tea is to be good and to remain good, it must be jealously excluded from a moist atmosphere. The tea should be put into the bins or chests, hot from firing, and as dry as it can be made without burning. Its subsequent value depends on the care with which it is kept hermetically closed until required for use. Even in an imperfectly made household "caddy" tea will deteriorate. Roasted and ground coffee requires even more care, for the tendency of the charred coffee is to imbibe not only moisture but mephitic gases.—*Ceylon Observer*.

COFFEE.

THE PULNEYS AS A COFFEE DISTRICT.

MR. C. W. W. MARTIN, acting collector of Madura, in a letter to the acting chief secretary to Government from Madura, 11th January, said:—"In reply to your official memorandum, I have the honor to state that 1,987 acres of land appear to have been cultivated during the official year 1877-78 on the Pulneys, and the yield is estimated at 416,892 lbs.

	Acres.	Yield. Lbs.
Pulneys	1,987	416,892
Sirumalais	1,523	448,896
	3,510	865,788

Access is had to the coffee estates on the Pulneys by the Adalur Ghat, and now to a considerable extent by Colonel Law's new Ghat. There are also several hill roads leading from the plains direct to the coffee estates. Coffee planters complain bitterly of the bare-faced way in which they are robbed often by very small children employed by the hill Chetties. The yield on the Sirumalais is 448,896lbs. and the conditions of access are somewhat similar, there being a rideable road from the bottom to the top. Kodaikanal is the station of a second-class magistrate and the bottom of the Adalur Ghat is but nine miles from the joint-magistrate's and taluk station of Dindigul. The top of the Sirumalais can be reached from Dindigul in 3½ hours easily and the return journey is shorter." Mr. Martin having asked that the Coffee-Stealing Act might be extended to the Pulneys, sanction has been given, and the following notification published in the *Fort St. George Gazette*:—"Under the provisions of Section 2 of Act No. VIII. of 1878 ('The Madras Coffee-Stealing Prevention Act'), the Governor in Council is pleased to direct that the said Act shall take effect from and after this date in the Upper and Lower Pulneys and Sirumalais in the District of Madura."

LIBERIAN COFFEE IN TRAVANCORE.

MR. JOHN PAYNE writes to the Madras Agri-Horticultural Society :—"You may recollect the Society about a year ago presenting Messrs. C. B. Dowden &. Co., of Tuticorin, a dozen plants of the Liberian coffee. These they divided among myself and neighbours. Mr. E. Smedly of Arundel two, Mr. T. Miller of Hereford two, Mr. Mathison of Rosemount two, three were planted at Parapet (all in Travancore), and three were kindly given me which I transplanted here (at an elevation of about 2,250 feet) in large pots, 3 feet deep and 2½ wide, covering the same with glass globes, because of the cold and very wet and windy weather at the time ; one shortly afterwards died (it was barely alive when I got it,) the other for six months simply existed, though duly aired and cared for in every respect. Not having in that time grown in the least, I removed them to 'Courtallum,' planting them out in the open, at about at an elevation of 400 feet. Within a week they made a start, and are now doing wonderfully. I should tell you I broke up the pots they came in, and very naturally found a 'network' of roots ; these with a pair of sharp scissors I cut away until there was not a curved bit of root left, or any soil. I mention this, because the other nine plants were planted out by those among whom they were divided, with (in cases) the roots untouched ; in others but slightly pruned (one person planting out pot and all, straw round the pot just as he had received it ! happily the oversight was pointed out to him in time, and one of the two is doing well)—which will account for the throwing out of suckers, to the detriment of the plants and surprise of the growers. Of these nine plants, five are alive and most promising, and with one exception are finer than mine, which I account for by the fact of mine having been kept six months in an ungenial climate. I have no doubt they will in the end be as fine as any. It is allowed, mine for symmetry and being perfect plants carry off the palm. I merely mention this by way of information, and for the benefit of those who may have to transplant plants that have been long confined in a small space, and the roots of which are entangled and altogether out of proportion to that part of the plant above ground. About the same time that the Society gave Messrs. C. B. Dowden & Co., the plants above referred to, it presented twenty to the Scottish India Coffee Company of Travancore. These Mr. James Grant, the manager of the Company, the other day, told me were doing well, and some far exceeded mine in size, but for symmetry, mine were to be preferred, and he had no doubt would soon overtake the others. Mr. Grant expects his to crop next year. The Liberian coffee plants in Madras, so far as the Honorary Secretary can judge, are not doing at all well, though he still hopes to see them improve during this cold weather now commencing, and to be able to write a full report on the subject next year. The plants sent to Travancore were as received from Kew, and were most probably, and so far as the Society is aware, all of one kind, though the habit of two or three of those retained in the gardens differs slightly from that of the majority."

COFFEE LEAF DISEASE.

RESULTS OF EXPERIMENTS CARRIED ON AT WALLAHA ESTATE, LINDULA, JANUARY 1879.

IT has been suggested that, in view of the many experiments that will probably be tried to check leaf disease during the coming season, an outline sketch of the experiments lately carried on at Wallaha and the results obtained therefrom might be of service.

In the following remarks I have tried to summarize what is at present known of *Hemileia vastatrix* and discussed what appear to be the most suitable stages for the application of remedies. I have given special prominence to the effects of sulphur and lime in checking leaf disease from the fact that the two specifics will probably be tried more than any other on a large scale.

In deciding whether sulphur or lime is to be used on a estate at any given time as a remedy for leaf-disease, it is important to note the exact stage of the disease as it shows itself on the coffee trees. If we divide the

LIFE HISTORY OF THE HEMILEIA.

into three periods, under ordinary circumstances, in its *first stage* it consists of fine filamentous threads growing with great rapidity and covering the stem, branches and leaves with a fine network of branching mycelium. This stage lasts for a longer or shorter time (probably from December to March), depending upon the amount of moisture present, and the size of the tree ; the filaments in this stage evidently derive all their nourishment from the moist shaded atmosphere in which they grow, and have no injurious effect upon the tree. But when they reach the leaves they soon begin their work of destruction. The upper side of the leaves being covered by the coating of tough gutta-percha-like substance and having no pores or stomata, the filaments are unable to penetrate it, but on the lower side the leaf does not offer so strong a resistance, and is so full of pores or *stomata* that the filaments find no difficulty whatever—especially in damp weather, when the stomata are wide open—in gaining admission to the intercellular tissue of the leaf. This intercellular tissue occupies the central and lower portion on the leaf and is made up of irregularly placed cells closely packed together, in which, under the influence of sunlight, the food of the plant is elaborated and prepared. These cells, in fact act as a stomach to the plant and carry on a work in the economy of plant life similar to digestion in the animal world. As soon as the filaments of the *Hemileia* reach this intercellular tissue, they tap cell after cell and feed upon their contents. In this way the vital machinery of the coffee tree is destroyed, and it is no matter of surprise that trees affected by leaf-disease suffer a gradual loss of vital energy or that repeated attacks, destroying the young leaves as soon as they appear, at length seriously affect their powers as crop-producers.

The filaments in the first stage, *i. e.*, before they enter the leaves, are so minute, that it is impossible to detect them without the aid of the microscope ; their extreme minuteness may be judged from the fact that it takes nearly 40,000 to make up an inch in diameter.

In the *second stage* the filaments are well established within the tissue of the coffee leaves, and they branch and ramify amongst the intercelluary tissues in all directions. Instead of being long and slender and moderately branched, as they appear on the outside of the leaves, they now assume a thicker, more branched, and a coral-like habit. The terminatives of each branch may be seen in contact and often penetrating the walls of the cells, and gradually the cell contents are absorbed and taken up by the parasite.

The destruction of the intercellular tissues by the filaments may be soon detected even by the naked eye for if the leaves are held up to the light a number of semi-transparent spots dotted here and there over their surface reveal the several points of the attack. As the work of destruction proceeds the leaves become more and more transparent till at last they are almost entirely deprived of their intercellular tissue, and if they do not fall they hang as useless appendages in the economy of plant life.

In the *third and last stage* the disease shews itself unmistakably in the now familiar orange-coloured powder which often covers the whole of the under side of the coffee leaves. The filaments having reached maturity once more push their way through the stomata, and appear on the outside as minute tufts of flexuous threads surmounted by a single sub reniform spore attached obliquely at the base.

Under a moderate magnifying power the spores appears as somewhat kidney-shaped bodies covered on all sides but one with tubercles or wart-like a papilleform point. *As the spores ripen, many of them* fall to the ground or get blown away by the wind, but the greater number remain on the leaves till all the latter are shed.

Judging from the heavy, oily character of the spores, it is probable that most of them remain in the immediate neighbourhood of the tree and except under the influence of strong winds are not distributed over very wide areas. The very rapid spread of the disease may be accounted for by other means than the distribution of these orange-coloured spores, and if what is mentioned in the next paragraph is found to exist to a large extent on coffee trees, it will afford another strong inducement for attempting to check the disease in its first or filamentous stage. After the spores have fallen to the ground or are attached to the stem and branches of the coffee tree, they begin (after a longer or shorter period of rest, to germinate, and the filaments thus produced once more attack the foliage, and the disease once more goes through its several stages as detailed above.

SECONDARY SPORES.

As pointed out by Dr. Thwaites in his report of March 1874, the *Hemileia* under certain conditions reproduces itself by means of *secondary spores* given off by conidia-bearing branches of the filaments. In the report just referred to, Dr. Thwaites, speaking of these secondary spores says :—" At the termination of some of these branches (of the filaments) secondary spores are produced in the form of radiating necklace-shaped strings of little spherical bodies of uniform size, and this form closely resembles the fructification of an *Aspergillus*. Mr. Abbay has also observed another form of secondary spores arranged in single rows of spherical bodies, a good deal larger than those radiately arranged, but still exceedingly minute. These inconceivably numerous secondary spores may be easily carried by the wind into surrounding districts and thus convey infection to distant plantations.

If these secondary spores are produced under normal conditions by the filaments on the coffee trees, they are evidently a source of greater danger as infection-carriers than the orange-coloured spores, and, as pointed out above, they afford an additional argument in favour of

attacking the filaments and destroying them as early in their development as possible.

Many leaves covered by filaments and evidently suffering from leaf disease fall to the ground without producing the orange-coloured spores; this is especially noticeable on old or abandoned estates and on native coffee. It is very probable that under such circumstances (want of sufficient food and poverty of growth) the filaments produce secondary spores in inconceiveable numbers, and if this conjecture is found by subsequent observation to be true, the existence of large areas of abandoned or badly cultivated coffee, (apart from other considerations) is a source of the greatest danger to coffee cultivation in the Island, and must counteract much of the good effected by remedial measures adopted on well-cultivated and highly manured estates.

This danger of infection cannot, however, be used as an argument against adopting any remedial measures on well cultivated estates, for many of them are so far removed from such centres of infection that by the application of remedies they may at least gain one, if not a two years immunity from leaf disease, and the return thus obtained in extra crop would more than compensate for the outlay incidental to the application of lime and sulphur

In the Application of Sulphur

as a specific for leaf disease it is intended, as in the case of the hop mildew, to be a precautionery measure and to act as a check on the disease in its first or filamentous stage, and while it is still an *external* parasite. This is most important, because the disease generally reaches its maximum just before crop time, when the trees can least bear the exhausting effects of *Hemileia* and it is most necessary to check at the outset any development of the *secondary* spores. As the filaments can only be detected in the first stage by the microscope, it is advisable to treat all the trees on an estate, even the healthiest with sulphur. If during the month of February, March, and April advantage be taken of heavy dews to apply sulphur to every part of the coffee trees and on the ground, its value as a specific for leaf disease ought to be apparant during the coming crop time. From the experiments carried on at Wallaba it is evident that when sulphur comes in contact with the filaments and spores it completely destroys their vitality, and if carefully applied cannot fail to lessen the severity of next season's attack.

Flowers of sulphur are preferable to *sulphur vivum* or black sulphur, because it a more certain in its action, and being heavier sticks better to the leaves. If flowers of sulphur can be obtained at Rs. 1[illegible] per ton, it will be much cheaper in the long run than *sulphur vivum* (refuse sulphur) at Rs. 100 per ton. In applying sulphur on a large scale it will require at least 20 sulphur blowers to begin with. If ten coolies are placed to each row—one to use the blower and the other to hold up the leaves so that they can be well powdered underneath—40 coolies thus employed ought to treat 600 trees per hour. On sunny slopes they will not be able to work more than one hour each day, as the dew so soon disappears, but they might be transferred to the nearest shaded slope facing west, where the dew remains, in some cases, it till 9 o'clock. The precarious and uncertain nature of the dew is no doubt a serious hindrance to the application of sulphur on a large scale, but if all the materials for sulphuring are kept ready at hand and a set of coolies—say pruners—are especially reserved for this work and started at day break, much might be done in a few week.

With an abundant supply of dew, the sulphur blowers completely cover the branches and foliage of the trees with a thin uniform coating of sulphur, which remains on the trees for several days, even after heavy rain. Soon after it is applied the sulphur gives off a faint pungent odour distinguished as that of burning brimstone; this is not the smell of sulphur itself but that of *sulphourous anhydride*, SO^2 formed by the combination of sulphur with oxygen. This sulphurous anhydride, or sulphurous acid as it is sometimes called, is a deadly enemy to the fungus, while it is comparatively harmless to the coffee tree.

As in the second stage the filaments are safely lodged within the tissue of the leaves, it is almost impossible to reach them, without at the same time destroying the leaves themselves. This was the difficulty which presented itself to scientific men at home, and from an examination of the dry leaves alone, they were unable to detect the filaments externally, we can easily account for the hesitation with which Dr. Cooke and others recommended the use of sulphur as a remedy for leaf desease. (See report on coffee leaf disease, Indian Museum, 1876, p. 12.)

It the filaments on the outside of the branches and leaves are destroyed on the early part of the year by sulphur, and again if the spores on the newly fallen leaves, and on the ground, are destroyed later on by quick-lime the result must be a diminution of the attack in an aggravated form, and if persevered in, such a gradual amelioration of the disease on well-cultivated estates that its effect would be hardly felt at all.

The application of a prepared

Solution of Lime Sulphur,

which has been recommended by Mr. Abbay, and more recently by Dr. Dias, may have some effect in this stage, if it is practicable to treat a large area with it. A similar preparation has been in use in England for many years as a disinfectant under the name of *Grigson's Mixture*. It is described fully in the *Gardeners Chronicle*, 1854 p. 595.

In experiments with this mixture, which have come under my notice, the solution in the one case was so corrosive that it destroyed all the leaves and in the other was so weak that it was perfectly innocuous. If the solution can be so prepared that it will destroy the filaments of the leaf disease without injury to the coffee tree, the problem will still remain how to apply a liquid of this nature systematically and economically, *of a given uniform strength*, to so large an area as a coffee estate. In any case great care is required in conducting experiments with it, and at first it would be well to operate on comparatively worthless trees. The application of Condy's fluid recommended by Dr. Cooke, lies under many of the disadvantages of the above, but has the one merit of being easily mixed in suitable proportions.

The Fumigating Process,

of which, I believe, Mr. Wall is the consistent advocate, deserves to be carefully tried as a specific in stages one and two. The strong fumes of burning sulphur will undoubtedly kill the filaments and spores of the *Hemileia*, but the process requires to be conducted with caution, in order at the same time not to injure young foliage and flower buds. I regret that I have not had opportunities of seeing the plan tried or of examining filaments and spores under the microscope after they have been subjected to the fumigating process.

Lime, from the difficulty of applying it effectually to all parts of the leaves and smaller branches, and from its uncertain action, especially in dry weather, does not commend itself as a specific for general adoption at this (the first) stage of the disease. From what I saw of its action on Wallaba I would recommend that it be tried as a disinfectant later on, *viz.*:—in the third stage when the trees and ground are strewn with the orange-coloured sporangia.

Application of Coral Lime.

In the experiments with lime, it was observed that the quicklime derived from the ordinary dolomatic limestone of the hills was not strong enough to effectually destroy the spores and filaments, and it would be desirable to experiment in the future with coral lime applied in a dry powdery state as soon as possible after it has left the kiln, and plentifully distribute it over the stem and branches of the trees, and especially over the withered leaves lying on the ground. The most favourable season for the application of lime is just after a severe attack of the disease, when the leaves have nearly all fallen. If quicklime is then applied it will destroy all the spores with which it comes in contact, and by decomposing the withered leaves *in situ* prevent the danger of infection. The plan of

Collecting all the Fallen Leaves,

and burning them, which has been advocated, as a precautionary measure with regard to leaf disease, is a good one if generally applicable to large estates, but I noticed that after a short time very few, if any, of the withered leaves under the coffee retain the spores upon them. The latter soon fall off and are found everywhere on the ground, where sooner or later they germinate and produce filaments which once more attack the tree. It is evident, therefore, that by collecting the withered leaves and burning them, only a small proportion of the spores is destroyed, and taking into consideration the cost of collecting the leaves the damage of a fire on a coffee estate, and the probable scattering of the dry ripe spores which must inevitably take place when the leaves are disturbed, I venture to suggest that it is much better to act on the old proverb, "to let sleeping dogs lie," and destroy leaves, spores, filaments and all with as little disturbance as possible by a plentiful application of quicklime. The value of the lime as a dressing for the soil, and the facility and ease with which it can be applied, are additional points in its favour.

As an alternative process, where it is not possible to apply lime to the whole of the estate at once, the recently fallen leaves, together with a little of the surface soil, might be scraped together, after a severe attack of leaf disease, into one of the number-one *water-holes* found on most estates, and covered over by a small quantity of quicklime. In this way a larger number of spores and diseased leaves might be destroyed at a very trifling cost.

D. MORRIS.

SCIENTIFIC CULTURE OF COFFEE.

THE following is Mr. James Sinclair's contribution to the leaf disease discussion :—

Lindula, 6th December 1878.

Dear Sir,—It has frequently occurred to me, that, in directing our attention *entirely* to the discovery of an antidote for leaf disease, we may be ignoring what is, to my mind, of much more importance, *viz.*, the cause of its appearance on our coffee and a means for preventing it.

Prevention is better than cure!

That specific for this pest will be found in our day, I have no faith in and even if found I doubt the value thereof. That we shall ultimately overcome this great enemy to coffee, I have as little doubt, and that not in the far future. May good luck nevertheless attend the experiments of those who are trying sulphur, porter, &c.

I ask you what would be thought of a community who, in the case of an epidemic caused by bad drainage, bestowed their whole care and attention to curing the sick instead of at once improving their sanitary arrangements.

In my experience of agriculture at home and in coffee planting here, which extends over nearly twenty years, I have proved more than once that any failure of crops by disease is due solely to preventible causes, to a neglect of the laws of good husbandry, not wilfully of course, but through want of knowledge.

At this moment I do not recollect a single instance of a specific being discovered for any of the numerous pests which the farmer

in England is troubled with. Every now and again in the agricultural papers you will read of certain cures, but as a rule, on being submitted to fair trials, they are found wanting. Nevertheless most of the diseases have been either stamped out or are being very successfully combated, but not by an antidote. Even that direst of them all, "potatoe blight" is being gradually conquered and will doubtless in time disappear. Turnip disease, which caused the utmost consternation among farmers on the lighter soils of Aberdeenshire about fourteen years ago, is now so harmless in its effects that you seldom or never hear it spoken of.

So important is this crop to the farmer, that all the agricultural and chemical science possible was brought to bear on it. This, that, and the other cure, such as lime, salt, sulphur, sulphuric acid, &c., were suggested without much, if any, good result.

The farmers gave science up in despair and settled themselves down to watch the effect of different manures, the seasons for applying them, the different methods of cultivating the soil for this plant, till at last it began to dawn upon them that the style of cultivation was bad, and although with ill-treatment they had for a time succeeded in raising good crops, yet the day of reckoning had come, and their whole system must be changed. This has been done and with the very best results.

Now, sir, don't you think that something may be learnt from this? Depend on it, leaf disease is no special visitation of Providence, in the usually accepted sense. "As we have sowed, so are we reaping."

I wish I were as sure that I could point out wherein we have more specially committed a breach of the laws of good husbandry, as I feel certain that we *have brought this on ourselves.* Chiefest amongst them and I make these remarks with due deference to men of longer experience in coffee than I have, is want of judicious and seasonable tillage, a want of method in manuring, &c.

The importance of stirring up soil in England is so well understood that it would be almost superfluous to dilate on it. A striking proof of the advance made in mechanical cultivation during the last few years could be readily understood by a visit to the Paris Exhibition, where implements of all descriptions and prices were to be seen for tilling the soil.

I have beyond a doubt proved to *myself* in Dimbula, how beneficial digging up the soil is, and, in this valley at least, the deeper the better. Soils as a rule, in fact all soils, require aerating or oxidation, now and again, but especially Ceylon soil, where so many of the lower compounds of iron abound, rendering it noxious to vegetation growths.

I have no doubt but that the coffee tree, like many others, exudes or excretes matter deleterious to the soil, which will in course of time render it quite unfit for its growth. I have read of whole forests of vigorous-looking oaks suddenly dying out and in their stead birches springing up and flourishing and in a few years scarcely an oak to be seen. I should think this is a case of the soil being gradually poisoned so to speak, whereas, had it been practicable to expose the soil to the atmosphere, the oaks might still have thriven. What is it but the air and rain water getting into the soil by the edges and interstices of the rocks that makes the coffee bean so well thrive.

But apart from the benefit of exposure to atmospheric influence, by digging a great deal of what must be otherwise wasted would remain in the soil. At the beginning of the year, when crop and pruning have been finished, an enormous quantity of vegetable matter remains on the surface. Now the larger proportion of this useful fertilizer must be carried off by the drenching monsoon rains instead of being taken into the soil, which it would be were it slackened up.

Vegetable matter is most useful as a fertilizer only in containing in the right proportions and in proper condition for absorption by the roots of plants, all that is essential for plant life. Another plea for tillage is that it unsuits the soil for insect or grub life.

In many cases where tillage to a certain extent is carried on—I mean in digging holes for manure, leaf disease, if not caused, is aggravated to a considerable extent so that even in tillage care and judgment must be exercised. A field ought not to be touched with mamotie or hoe for manuring while the soil is quite saturated with water; nothing is so noxious to the soil; of course you can till your soil in a too dry state as well as too wet.

The seasonable tilling of land in England is so well understood now, that should a season chance to be a very wet one while the soil is being turned over, the farmer will tell you that his crops will be attacked by all the diseases they are subject to; every one of them will appear in an aggravated form.

Some very striking instances of this have come under my own observations, but this epistle is already too long.

Liming is a branch of manuring that is much neglected in cultivating coffee.

The same object is frequently attained by an application of quicklime chemically as is secured mechanically by digging. Professor Tanner, of the Royal Agricultural College, in his "Elements of Agriculture" says:—

The advantages arising from the use of caustic lime may be enumerated as follows:—

(1) It encourages the decomposition of the organic matter in the soil.

(2) It neutralises the organic acids which make land sour.

(3) It assists the liberation of the alkaline matters (potash and soda) from the dormant ingredients in the soil.

(4) It promotes the formation of the double silicates.

(5) It favors the production of nitrates of potash.

(6) It contributes food essential for the perfect growth of plants.

(7) It improves the physical character of the soil and promotes healthy growth.

Surely the above is sufficient to convince us of the need we have for a more extensive application of this fertilizer.

Doubtless there are many other ways than that mentioned whereby we *miscultivate* our estates. They will gradually, as we gain experience, have to give a place to a more systematic, more enlightened method of cultivation.

I have no doubt but that the day is close at hand when we shall look back and wonder how the coffee tree lived under the treatment we had been submitting it to.

What is wanted is careful experiment by keen observers—practical men. Frequent association meetings for the purpose of exchanging views and getting fresh ideas. Thus will leaf disease ultimately be stamped out body and soul.

Now a word to those who have seasonably dug, drained, limed and manured, and all in vain; also to those who say they have leaf disease on their unexhausted soil of young clearings.

Disease once generated will attack the well located, well conditioned tree as it will the well conditioned animal, but they suffer less.

Apologizing for occupying so much space, and in hopes that these views may lead to some discussion, from which at least some benefit may be derived.—Faithfully yours,

JAMES SINCLAIR.

AGRICULTURE FOR PLANTERS.

By A. C. Dixon, F.C.S., M.R.A.S.E., B. Sc. & Sci. M, B, (London.)

HAVING pointed out briefly the general geological relations, the physicial properties, and the chemical composition of the soil, as found in Ceylon, and shown that it is of great practical importance to the cultivator to possess some knowledge of its physical and chemical conditions, which reveal the active and dormant powers, and the conditions regulating the transition from a dormant to an active conditon, available for vegetable life, we may now consider its suitability for various crops. The form and elevation of the land, together with the prevailing winds and rain, require to be taken into consideration. Coffee is capable of being produced with profit at various altitudes, from 2,500 feet to 4,500. This may be extended in either direction. Certain kinds, such as Liberian, may even flourish at sea level. Flat districts are generally avoided for ordinary coffee, as the water is apt to accumulate, and *resting in the subsoil does not give the roots full play.* This is much more evident, however, in the case of cinchona, which is near akin to coffee. Food may be eaten by us, but if the stomach juices, such as the gastric, are not there to transform it into such a state as adapts it to the requirements of the body, it will do us no good, nor, if other juices are there, which ought not to be present, will it benefit the body, although all the elements of nutrition may be found. In the same way, the subsoil may endanger the prosperity of the plant.

A careful cultivator will therefore look well to his soil, and can soon find out whether it is too heavy or too light, or, it may be loaded with elements it does not require. If the soil be too stiff and heavy, his mind will naturally suggest lime, or even sand, to keep it open. At the same time, we must bear in mind, that crops may be found which would enjoy a stiff soil.

Again, if too porous, and therefore probably not sufficiently retentive of moisture, he may put clay or heavy soil upon it with advantage. He may keep a heavy soil open, and in a very proper manner too, by bringing leaves, twigs, or other bulky matters into play upon it. The rain-fall in Ceylon, although somewhat out of the ordinary course of things, during the present year, is not too much for coffee. It can stand even more than it has experienced during the last twelve months. If the estates are properly drained, they will not be burdened with moisture—nor if drought should come—and no doubt it will, for even in a climate like this, we cannot get rid of the law, that action and reaction are equal and opposite—it will not suffer much. Soil in a good physical state will draw moisture from the air, and many plants evaporate more water than the rain-fall around them will account for, and this is merely by the wise arrangement that the air always contains more or less moisture. Where we have great heat, we must, as a rule, have great rain-fall, either in the form of actual rain, or dew. As a guide to what a soil is likely to do, it would be advisable to examine the nature of the vegetation already there, and the mode in which it grows. If there is abundance of trees or undergrowth we may take it for granted that the soil has plenty of plant-producing power. The natural vegetation will give us an idea of the depth of the soil, according as it is surface or deep rooted.

We may have plenty of undergrowth, however, of the lower forms of vegetable life, some of which, ferns for instance, do not speak ill of the soil, while others, such as mosses and liverwort, (*Polymorphia marchantia*), great beds of which, I have seen up-country, naturally like boggy places; the soil, or rather peaty matter, is often impregnated to a great extent with iron.

We may have potash, lime, or silica secreting plants, according to the nature of the soil. The weed so common on many estates here—the goat weed, (*Ageratum*)—has similar requirements to coffee, hence this weed is a good index to the soil. It may be troublesome, but it will help to form a very good compost heap. These weeds should not be despised, for if kept in check, they are converting good matter into a better form, and this is not going to be removed from the estate, but returned to it again to form humus. We must not forget that the humus we meet with in the soil is formed of past vegetation ; it is not the cause, but the effect. We may say, in fact, that as iron sharpeneth iron, so cultivation sharpeneth the soil.

The forests, of course, require attention if they are to be profitable to a ~~country, but only a few~~ nations have paid any attention to this branch of agriculture. Perhaps the Germans and French head the list, and it is at the forestry schools of those countries that candidates for that branch of the service must study for some portion of time previous to their being sent out for permanent employment.

A soil over-worked with coffee might be relieved with cinchona, which is not cultivated for fruit, except for the sake of seed, or by tea, which produces a leaf crop. Fruit, leaves, and bark require different matters for their perfection.

The mode of dealing with the rain-fall is a point worthy of consideration. Rain is a most valuable servant, but it must be kept under control. It is too much the custom to treat it as an enemy, which we should clear out as rapidly as possible, instead of controlling it by abstracting the gases, such as carbonic acid, ammonia, and nitric acid, generated by the lightning, in passing through the atmosphere, and regulating the supplies, so as to store them in case of deficiency.

Stagnant water on land is injurious, and in order to prevent this, we must have drainage. Nature has carved out her main drains, and if we wish to get the full effect from the soil around these we must add the capillaries in such a manner as to get the full benefit from the water before it reaches the main branches of the rivers. The mere overflowing of water over tracts of land seldom does much harm, but if it is allowed to become stagnant, it injures the soil considerably, and when it dries up, the sun, acting on the decaying vegetable matter, creates malaria in the neighbourhood.

Dense jungle is almost always moist, for evaporation is checked by the shade of the foliage. The trees, also, condense the vapour in the atmosphere.

The force which removes the rainfall from the soil to the ocean is gravity, or the force of the attraction which the earth exercises on all bodies in a direction perpendicular to the surface of the ocean. The vertical space through which the water moves, is called its fall, and dividing the length of its course by this fall, we get the rate of fall or inclination. When water passes over water, the friction is less than when it passes over the earth, therefore the smaller the surface of earth which the water touches in its course, the smaller the friction. Hence water in a narrow channel will move more rapidly than in a broad and shallow one.

We next come to tillage. We till the ground in order to break it up, and to give the air full play within, as the air helps to digest the food in the soil, and to make it ready for the plant. Tillage is always followed by a good effect, although manuring may not have the same result. Man exerts a great influence on the soil either in the way of improving or impoverishing it. The most fertile soil may become barren by continuous cropping. The term permanent fertility is not applicable in its full sense to any kind of soil, for however rich it may be naturally, its productive power will be diminished from year to year—it may be slowly, but yet surely if no provision is made to restore to it the elements of fertility which have been removed during a long series of years.

I will now give an analysis of an estate soil which I made a short time ago for a gentleman up-country.

Moisture ...	8·4
Organic matter	12·14
Iron oxide	6·38
Alumina ...	8·01
Lime	·23
Magnesia ...	·18
Potash ...	·21
Soda	·07
Phosphoric acid	·17
Sulphuric acid	·1
Silica soluble	2·05
Insoluble silicates	67·05
Traces of chlorine	
Carbonic acid, &c.	

Of the insoluble silicates 17·54 per cent. was quartz, and the nitrogen in organic matter ·19.

I have stated this in the usual form, as much divergence therefrom would probably not be understood; in fact, I am somewhat doubtful whether even this ordinary form is intelligible to many. Some have an idea that the more items the better. For my own part, as far as practical agriculture is concerned I hold that the fewer is the better plan. We only require to know the essential and detrimental elements of plant life. The selection of a sample of soil is important, and I will therefore give the mode of selection recommended to the members of the Royal Agricultural Society of England, by Dr. A. Voelcker, the Consulting Chemist. It is as follows :—

" Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field, mark out in the field a space of about 12 inches square ; dig round in a slanting direction a trench so as to leave undisturbed a block of soil with its subsoil from 9 to 12 inches deep. Trim this block to make it fit into the wooden box ; invert the open box over it ; press down firmly ; then pass a spade under the box and lift it up gently. Turn over the box, nail on the lid, and send to the laboratory. " With coffee soils I would recommend that a deeper portion should be sent.

I will endeavour to explain the foregoing analysis, but in order to make it clear, I must say a something respecting chemical elements. In the elements of our language the letters are divisible in two groups—vowels and consonants. The chemical elements are also divisible into two—the non-metals and the metals. The non-metals of the cultivator are oxygen, hydrogen, nitrogen, carbon, chlorine, sulphur, and silicon. The metals are potassium, sodium, calcium, iron, manganese, and aluminium. Some of these are solids, other gases, some have an affinity the one for the other, and form binary compounds such as carbonic acid gas, a compound of carbon oxygen, and without which plants could not live. A tertiary compound such as sulphuric acid, consists of sulphur, oxygen, and hydrogen. Quaternary compounds, such as quinine, contain carbon, hydrogen, oxygen, and nitrogen. Oxygen, an invisible gas, one of the components of the atmosphere, when it unites with another element, is said to form an oxide. Thus the water we drink is an oxide of hydrogen. The potash we note in the analysis is oxide of the metal potassium, a solid substance. Soda is the oxide of the metal sodium, protoxide of iron is one of the oxides of the metal iron. Alumina, magnesium, and lime are the oxides of the metal aluminum, magnesium and calcium. These oxides are also called bases, since they readily unite with acids to form a salt. For example, hydrochloric acid, better known perhaps as muriatic acid, or spirits of salt, unites with the base soda to form chloride of sodium, or common salt. Sulphate of calcium (gypsum) is a salt formed by the union of sulphuric acid with lime.

An acid is a compound of hydrogen, capable of uniting with a base to form a salt. If the acid contains only one atom of hydrogen it is said to be monobasic, and such acids can only form one class of salts, for example, chloride of potassium, where the hydrogen of the hydrochloric acid has been displaced by the metal potassium. *Sulphuric* acid is dibasic. It contains two atoms of displaceable hydrogen, and can therefore form two classes of salts,—the one normal, where both the atoms of hydrogen are displaced, as in sulphate of soda, or one only may be displaced, forming another sulphate of soda—the acid sulphate so called because it has an acid character. In like manner we have the normal and acid sulphates of potash.

Different elements have different values in exchange among themselves Should the metal displacing the hydrogen have double the value of an hydrogen atom, *e.g.*, calcium, then such element displaces at once the whole of the hydrogen, and we have as a result the normal sulphate of calcium. *Phosphoric* acid is tribasic. It can form three classes of salts —one normal, and two acid. It is on account of this tribasic character that the composition of the salts called phosphates are somewhat difficult to understand.

Now, sulphuric, phosphoric, and silicic acids are mentioned in the analysis, but the reader must not imagine that the soil contains them in the uncombined state in which they are expressed on paper. So long as there are bases in the soil which they like, or scientifically for which they have an affinity, they will unite with them. The sulphuric acid may be there in the form of sulphate of calcium or other base. Phosphoric acid occurring in the soil results from the mineral apatite which is a phosphate of calcium. Without a sufficiency of phosphoric acid we can never get the fruit to mature, so that we need not be surprised to find a tree bring forth sufficient flower, but yet be unable to perfect it.

In order to understand chemical affinity, let a few drops of sulphuric acid be put into a glass of water containing lime in solution ; the acid will immediately lay hold of the lime, forming a white precipitate ; or

should a few drops of the same acid be poured upon a piece of iron, we shall again see the affinity, the acid taking possession of the iron to form sulphate of iron, while the hydrogen is set free.

The insoluble silicates, minus the quartz which is estimated along with them, are silicates of potash and alumina.

Iron, one of the elements in the soil, has given rise to considerable discussion. Vegetation cannot live without it. It is one of the necessary components of that substance called chlorophyll, which imparts the green colour to vegetation, and yet iron, although necessary, if in too great quantity, is injurious. The question naturally arises. How is this? Iron and its kinsman, manganese, the oxides of which tinge our various rocks and soils, exist in two distinct chemical states,—one in which it is fully engaged with other elements, for which it has affinity; and another where it is not so fully occupied. The fully engaged form is the peroxide, the other is the protoxide. This less engaged form is very ready to raise itself to the higher state by taking up oxygen from the air, but this oxygen is required for other purposes, such as to burn up the humus and other matters we chose to put into the soil. These are burnt slowly, without emitting light, just as the oxygen we breathe is used to burn our own food, and furnish us with heat, as well as forming, as a result of burning, carbonic acid gas. If, therefore, the attention of this oxygen is diverted by the presence of the lower oxide of iron, which would be the case to a considerable extent in turning up many subsoils, what else can we expect than injurious effects? The oxygen cannot attend to the iron and its other work simultaneously. As soon as it has satisfied the iron, it will resume its ordinary work.

Some subsoils, when turned up, require frequent working in order to oxidize the iron as quickly as possible. *Sulphur*, one of the components of sulphuric acid, and about which a great deal has been said of late in connection with leaf disease, is very different from sulphuric acid. A planter may read an analysis, and find there sulphuric acid, but this has nothing to do with the leaf disease, nor will sulphur have any effect upon it if placed in the soil, for slow oxidation would then take place, and a resultant compound will be formed called sulphurous *anhydride*, or *sulphurous* acid minus water. All anhydrides are soluble in water, and thus when formed it is not much unlike protoxide of iron in its behaviour. The sulphur in this state is not in full activity; it will readily take up more oxygen, and be converted into sulphuric acid, eventually uniting with some base in the soil, forming a sulphate. If, then, planters think that sulphur put into the soil would be effective, they had better apply sulphate of ammonia at once. Sulphur sprinkled on the leaf while moist, no doubt would be beneficial in its action.

We will now say a little about manures, or those substances we employ for restoring, maintaining, or improving the fertility of a soil. Manures may be divided into three classes: animal, vegetable, and mineral.

The most important is farmyard manure, or in this country cattle dung and urine. The vegetable matter, which has been used in bedding, and earthy matter, which has absorbed the liquid portion, is also of great value.

This may well be called the most valuable manure, since it contains all the mineral ingredients for coffee, and an application of this to each tree would improve the yield, as well as maintain it for two or three years, according to the nature of the soil. Cattle dung is formed from the vegetable matter upon which the animals have been fed, and from which they have assimilated what they required and rejected the rest. It is evident, therefore, that the manure from young animals is not so rich as that from full grown ones, since they require incombustible elements to build up their bones and flesh. The quality also depends on the nature of the food taken, and on the manner in which it is preserved before its being applied to soil. The absorption of the urine voided by the animal greatly increases the value of the solid manure, since it is rich in urea and uric acid, both of which contain nitrogen. The absorption is best accomplished by a free use of earth, straw, or other litter. Straw, being tubular, retains a great quantity, and when it rots adds its own mineral elements to the manure.

Manure may, however, be allowed to become too rotten, and in such a state the gases of decomposition will pass into the atmosphere unless the heaps be protected. On heavy soils, it is well to put it in the ground in a half rotten state, since it helps to keep the soil open. At the best it is but an irregular mixture. One thousand pounds of cattle dung yields about 6 pounds of potash, 10 of ammonia, 3 of phosphate of lime, and 800 of water. The ammonia would result from the decomposition of the nitrogen contained in the dung.

Cattle dung contains all the essential ingredients of the coffee bean, and it is for this that a planter has to apply manure; not for leaves, stem, or pulp, since these are not, or ought not to be, removed. We cannot increase the crop proportionally by adding proportionate quantities of dung. The whole mass in the soil does not come into contact with the root hairs in one year. The continuance of its effect is due to the diffusion which takes place gradually, so that to get an increased effect in a given time, we must apply a much larger mass of manure than that which contains just the required increase of mineral matter in the bean.

But even this is limited by Liebig's well-known law of minimum. "Every soil has a maximum of one or several elements of nutrition, and a minimum of one or several, and it is by the minimum that the crop is governed." We require a certain number of bullock carts to convey from an estate a certain quantity of coffee. If there are more carts than coffee, the coffee is the minimum, and the quantity sent away depends on that minimum of more coffee than carts. The carts are the minimum, and still the quantity transported depends on that. Just in the same way soil must possess, for the production of coffee, potash and phosphoric acid; if potash is in minimum, then phosphoric manures are useless to such soils; or if phosphoric acid is in minimum, then potash manures, if added, are without effect, at least, as far as the production of the crop in question is concerned, unless at the same time we add along with it phosphates to increase that which was in minimum. —*Ceylon Times*.

(To be continued.)

TOBACCO.

It is estimated the out-turn in good tobacco leaf from a properly cultivated acre of land ought not to be less than 800 lbs. In America the average is reported to be usually 1,000 lbs. East Indian tobacco generally sells in London for 1*d*. or 2*d*., and excellent varieties fetch about 5*d*. per lb. The Myouk-toung tobacco is so favorably spoken of that we may with some safety expect the latter price for it. Then if the Government farm there consists of 200 acres (this was its proposed extent.)

$800 \times 200 \times 5 = 800,000d.$, or Rs. 33,333 per acre

or Rs. 2,777-12 per month. Not an unprofitable speculation.

Native calculations, however give 370 lbs. as the average yield of an acre under tobacco cultivation. The calculations then would be

$370 \times 200 \times 5 = 370,000d.$, or Rs. 15,417 per acre

or about Rs. 1,285 per month, even this is not bad. It is probable however, that the native growth would not fetch so much as 5*d*. per lb. But in the Government farm at Ghazipore, and in Bengal farms, 800 lbs. have been readily obtained, and there is no reason why the superior soil and situation of Myouk-toung should not yield as much under proper care and scientific cultivation.

The following is a somewhat important para from the last *Burmah Gazette*:—

Tobacco of excellent quality is produced in Northern Arakan, but its commercial value is to some extent neutralized by the rude and ignorant system which the cultivators adopt in curing it. To educate them in this part of the work, a "farm" was established in the locality in 1877, under the charge of a European who had had large experience in cultivating and curing tobacco. Under his management there was every reason to hope for success; but he started the work much too late in the season, had to contend with very bad weather and a great scarcity of labourers, while, in addition to these drawbacks, he was suffering from a painful ailment from which he soon after died. His successor found matters in confusion, and has confined himself to growing a few acres only of tobacco, on the curing of which he is now engaged. The report on this crop by experts in Calcutta will probably decide the fate of the farm. Should it be continued, the intention is to make it a general nursery-ground,—not for tobacco alone, but for such other economical products as may be considered suitable. The climate is unhealthy,—all but prohibitive either to natives of India or to Europeans even of strong constitution, and, unless the labour question can be solved, there is little to hope for from a district which otherwise has within it the conditions of much possible wealth. The establishment of a steam-launch on the Koladyne river ought to be attended with excellent results.

NOTES ON SOME FOREIGN TOBACCOS AT THE PARIS EXHIBITION.

The following are a few short notes upon the exhibits of foreign tobaccos which were exhibited in the different foreign sections of the Paris Exhibition. Some new facts are also added, collected from the different catalogues, which all more or less contain information of value. The statistical and other information obtained from the different official publications is necessarily much compressed.

Spanish Colonies:—Amongst the different regions which produce the most aromatic tobaccos, alike noted for their *boquet* and their excellence, the island of Cuba is pre-eminently distinguished. The principal Havana manufacturers of cigars have made an excellent exhibition, and there can be no doubt that they have been careful to display only their very best productions. In the Moorish pavilion, where they are laid out, is to be seen, side by side with cigars of the most celebrated brands, leaf tobacco of incomparable flexibility, delicacy colour, and aroma. In fact, the perfection of cigars is to be seen both in the nature of the leaf and the mode of manufacture. In Cuba there are plantations renowned for their tobacco, like there are vine yards in Burgandy and the Bordelais celebrated for their wine; and amongst these the most distinguished in the Champs de Mars are undoubtedly the Lena, the Hotode la Cruz, and Rio Hondo, all in the Vuelta Abajo. The prices of the tobaccos exported from these plantations are very high; they sometimes even reach from 3,000 francs to 4,000 francs the quintal. The well-known brands seem equally to insist,

upon being remunerated for their reputation, and affix high prices to their cigars. We gather from the different Exhibition publications, that the whole of Cuba is not equally favourable to the cultivation of tobacco, but that the planters invariably limit their hopes to the district in which they grow, and are never foolish enough to experiment in obtaining a different species of tobacco to that for which the country is adapted. The richest districts are in the west of the colony. They are the Vuelta Abajo, *Patridos*, and Vuelta Ariba. The first-named is, as is well-known, the most important. Its annual production is about 400,000 bales, of which the average price varies between 20 and 30 piastres for each 100 kilos. of fillings, and from 160 to 200 piastres for the same amount of leaf. Sometimes 100 kilos. of very fine leaf have been known to fetch as much as 350 piastres. The other tobacco-producing districts are the Puerto Principe, Tierra de Adentro, Remedios, Gibara, &c. Here the average price is 12 piastres, the tobacco being of a more ordinary quality. The total production of the Island is now about 42,000,000 kilos., which is nearly one-tenth of the whole consumption of the entire world. In 1852 it was only 20,000,000 kilos. The average value of the harvest is £3,200,000. It is principally in the town of Havana itself that the principal factories are situated. The only protection they receive from the Government is that of their trade marks. These are too well-known to our readers to require recapitulation, but, awaiting the reports of the experts, they seem to occupy at the Exhibition the same positions they occupy in popular estimation. The prices of the cigars exhibited vary between 25 and 400 piastres per thousand. The consumption of indigenous cigars in Cuba alone is estimated at 600,000,000 per annum, and the export to foreign countries is put down at another 700,000,000. The Régie of Manilla and the Planters of Porto Rico have also come forth satisfactorily, but their exhibits poll ridiculously before those of the Pearl of the Antilles. The cheroots are very fine, and will no doubt receive some commendation, but the cigars, though well made, are not very pleasing.

Dutch Colonies.—The tobaccos exhibited in the Dutch section come partly from the mother country (which only produces very coarse tobacco, well adapted for mixing with weak species, of which it corrects the insipidity), partly from the colonies, and especially from Java and Sumatra. The leaf tobacco of Java is remarkable for its beautiful colour, the delicacy of its tissue, and its aroma, which recalls to our mind rather too emphatically the odour of pears. It is admirably adapted for covering cigars. After Cuba and Manilla, the best tobacco for everyday use undoubtedly is now coming from Java. The exports of leaf tobacco from this island are annually worth about £400,000.

Turkey.—The Turkish tobaccos are neither nationally nor worthily represented, and there is little to say respecting their appearance on the Champ de Mars. Some interesting facts are, however, to be obtained respecting them from several tobacco publications at present pervading the Exhibition. The quality of Turkish tobacco, usually very good, is due at once to the climate, to the nature of the soil, and to the particular care which is devoted to their culture, their drying, and their packing by the planters. The Ottoman Empire possesses plantations where, like in Cuba, specially good species are grown. There the price is about 15 per lb.—even sometimes higher for the productions of Yenidje-Karasow, where the best Turkish tobacco is grown,—which is quite as much, if not more, than the finest fancy Cuban leaf, which has been subject to especial attention. Turkey is pre-eminently the land of smoking. It is calculated that about 30,000,000 of Turks consume annually over 100,000,000 lbs. of tobacco, of which nearly the entire amount is used for smoking in pipes. In the Ottoman Empire the indigenous "weed" is subject to a tax entitled "murouryé," without the payment of which no transport is possible. This tax amounts to twelve piastres per oke, which is very large, and contributes considerably towards limiting the exportation. Those species which are particularly in request in foreign countries are the beautiful brown tobaccos of Salonica, Janina, Trebizond, Aleppo, Djebel, and Syria, and those darker and stronger of Mohalieben, Ali, Simer-Kile, Latakia, and Abou-Reha. The tobacco leaf receives in Turkey no other preparation for smoking than being cut very fine and pressed. The aroma for which it is so much liked is due to the species of fermentation which takes place whilst it is being pressed.

SERICULTURE.

TASAR SERICULTURE.

To the Secretary to Government,

General Department.

Jangaon, Ahmednagar, 10th January 1879.

Sir,—I have the honor to submit, for the information of Government the following account of my experiments in tasar sericulture during the past year :—

1. As mentioned in my last report dated 1st May 1877, when I left Poona on famine relief duty, I gave over everything connected with the subject to Mr. Woodrow, the Superintendent of the Government Botanical Gardens, Ganesh Khind, including the cash account of Rs. 871-7-6. In December 1877, I was transferred from the Dharwar to the Poona Revenue Survey, and on my return to the station of Poona in July 1878, for the monsoon recess, I resumed charge of the experiments. The cash balance then amounted to Rs. 421-5-8.

2. My former experiments, as well as those conducted by Mr. Woodrow, had proved that it was a mistake to attempt to rear these worms on twigs either cut from road-side trees, or from those which had received some care and attention in a garden, and that the plan most likely to succeed was to feed them on shrubs in localities where they could be protected from their enemies, and if need be, from unfavourable weather. With this view I began to collect young plants.

3. I had noticed in 1876 that the tasar worm throve well on Lagerstrœmia Indica, an ornamental shrub, fairly abundant in the cantonment of Poona; this is a plant which throws up a good many suckers during the monsoon, and I soon got a few plants together. I took a house which was well supplied with shade and water, and my gardener managed to collect 172 plants between December and July, many of them only a few inches high, but some were large enough to be of use. There were also in the ground 6 bushes, and my first care, when I came in from the districts, was to cut them all back to the hard wood, and apply to their roots a fair amount of manure. The consequence was that as soon as the rain commenced the plants shot most freely into leaf.

4. Mr. Woodrow had not been able to save any seed cocoons, but I had found three female cocoons in the districts, and the Marathi woman, who had been my chief assistant in looking after these worms before, had collected 12. I soon had several moths from these cocoons, and found, as I had noticed before, that there was no difficulty in getting an abundant supply of fertile eggs. Hardly any females were wasted; it was only necessary to put them out over night on any bush, and it was almost a certainty to find them paired at daybreak. I found that it was not necessary to tether them, they rarely moved from the twig on which I placed them. As fast as the young worms hatched out, I put the trays containing them among the leaves of the plants, and in a few hours they commenced feeding. The weather was everything I could desire, showery with a few breaks of fine weather; the bushes were full of young shoots, and the worms throve as I have never seen them thrive before. I tied bamboo screens together and covered over the plants as they stood in the open. The worms changed their skins at intervals of 4—5 days, instead of 5—8, as had been the case when I reared them indoors on gathered food, and they spun their cocoons in 28—35 days, instead of 40—50 as I had noted before. The moths came out of these cocoons in 27—30 days, and their eggs proved fertile, producing caterpillars which grew as fast and as large as the first. The only difference that I observed was that the "cement" of the cocoons of the later crops was less uniformly white; this may have been due to the changes in the weather or the quality of the leaf, some shrubs having been eaten off three and four times this monsoon.

5. The Lagerstrœmia bush proved an excellent food, it flushed so quickly that a plant 2 feet high, after being fed off quite bare, cut back and repotted, was again in thick leaf in a fortnight, and the same batch of worms stript it again. In changing the plants and in daily examining the cages, a few accidents occurred, but 100 worms yielded 71 cocoons.

6. I enclosed an old Carissa carandas, which had neither been pruned nor manured, with bamboo screens and liberated 50 worms there. In the course of a month, I gathered 31 cocoons, a little larger than those of the Lagerstrœmia, but much harder and yellower. The caterpillars seemed to thrive a little better on this bush, and completely stript it, but the tree did not recover quickly and did not yield another supply of food the whole monsoon.

7. I put six worms on to a young Zizyphus jujuba tree in my garden, but neither enclosed it, pruned it, nor manured it. It had a great deal of leaf and flower on it, and the worms ate both. They grew very large and healthy, being in every stage of their existence a little ahead of some of the same batch feeding on Lagerstrœmia. Five cocoons were spun here, larger than any that I had gathered from off the other trees.

8. I let the majority of the moths fly away, for so soon as the male has left her, the female is quite ready to go and look for suitable trees to deposit her eggs on. I had not enough food for more than 100 worms at a time in my own compound, and almost every attempt which I made at bringing them up elsewhere, unsheltered by the screens, failed. Crows, squirrels, and other enemies carried them off, and I hardly got a single cocoon; but in my own compound I continued to rear a few at a time, changing them from one tree to another as I found it expedient. The result of the experiments which I made showed me plainly that plants in the ground with or without screens over them, gave the most suitable food; that it mattered not whether the young shoots were eaten down by the caterpillars or cut off by the pruning shears. The Lagerstrœmia ever sprouted again, and it was only the very limited supply of food, which I had that prevented me rearing many more worms.

9. From the single experiment I have mentioned, Carissa does not seem to recover quickly. Zizyphus seems to grow very fast, principally at the extremities of its long straggling branches, but as I only had one tree in my compound, I could not be sure about its usual habit of growth.

10. I baked some of the cocoons gathered from each of these 3 trees and sent them home to Mr. Wardle, asking him to give me an opinion on the qualities of the respective fibres. I had all the burst and injured cocoons cleaned, and sent them, together with those which Mr. Woodrow had on hand, to the Alliance Mills in Bombay to be converted into yarn. I have kept some fifty seed cocoons for next year's experiments.

11. I have got together a good many plants for next season's experiments—353 Lagerstrœmia Indica; 10 Lagerstrœmia Parviflora; 13 Conocarpus Latifolia; plants and cuttings all rooted and in leaf; also 136 Carissa Carandas, 135 Zizyphus Jujuba, 105 Pentaptera Tomentosa, seedlings; there are besides 3 Zizyphus bushes in the compound; and if my gardener will but take care of these during my eight months' absence from Poona, I hope to resume my experiments under better auspices.

12. The past season has been very favourable for tasar worms. Mr. Lyle, who was cultivating them to a small extent at Dapuri in 1876,

tells me that some of the men who were under him then, came to him lately and asked him whether he wanted any more cocoons as they had seen several. He happened to be on the spot, and sent a man to see how many he could collect within 3 hours. He came back with 300, and said that he had heard that some people had been taking them into Poona for sale, presumably to the native physicians. I myself have already found many more casually this year in the districts than I usually do.

18. During the four months of the monsoon I spent Rs. 136-8-9 in forming the plantations I have enumerated in paragraph 11 and in protecting the worms while feeding. I have still 284-12-6 left out of the money placed at my disposal in 1875, and a detailed account of this expenditure has been submitted as usual to the Accountant-General.

G. COUSSMAKER, *Major*,
Assistant Superintendent, Revenue Survey.

"TUSSORE," IN THE PARIS EXHIBITION.

THE fact that the native silk tissues of India, with their gold and silver mixtures, exhibited in the great Exhibition of 1851, has had a wonderful effect upon the decorated textiles of England is now pretty generally acknowledged by those whose opinions are worth anything upon the subject. The high character of these fabrics, the wonderful texture, the perfect harmony of colour, were a revelation in 1851, and it has been a subject of great interest to inquire how the native weavers with their simple looms could produce such fabrics, and still more how they could with such certainty calculate upon the precision of effect desired being the result of certain combinations of dyed thread when wrought together. Attempts have been made over and over again to emulate, not to say imitate, these effects; but with all the appliances of modern chemistry as applied to silk dyeing, and the great variety of tint produced by these means, even when the original Indian pattern has been taken thread by thread, the European-woven counterpart, although frequently very effective, never had the charm of the original Eastern work, and almost every attempt to produce analogous fabrics in which the pattern was itself European invariably failed in the element of colour. The secret of the dyed silks of India appeared to be impenetrable, but why no one could tell; for, after all, the secret appeared to be on the surface; and so it really is.

The Commissioners for India brought together at the Paris Exhibition a very miscellaneous but very valuable and suggestive series of illustrations of native manufactures of a comparatively low and cheap character, examples of products common among the people of the various provinces of India; and amongst other illustrations was one of the native silk of India—the product of the Tasar, Tusseh, or Tussor worm, or wild silk also examples of the eggs from which moths have been developed during the last summer, and finally cocoons, &c. In addition to the silk itself in its primitive state, examples of thrown silk, "tram" and "organzine," and also dyed examples, there were exhibited specimens of the native dyes from the plants used by the natives for the production of those colours and tints which have been puzzling all Europe for at least the last quarter of a century. In the tints of the dyed skeins, we see the elements of the harmony of the native woven manufactures of India, not produced by costly materials and elaborate processes, but by the vegetable dyes obtained from the common plants of the country and applied by the same simple ingenuity, which reaches its culminating point in the primitive loom of Cashmere. The fabrics shown were chiefly dyed and printed, the printing having been affected in a very suitable and characteristic series of designs by Messrs. Wardle of Leek, to whom the Commissioners confided the experimental illustrations.

The practical issue of all this will, it is hoped, lead to the introduction commercially of these native dye stuffs to the silk and other dyers of Europe. The French silk manufacturers are greatly excited at the prospect of obtaining such dyes, and regard the little exhibit in the India section with unusual interest. It has, however, still to be seen how far the colour and the quality of European silks will come through the process of dyeing with those dye stuffs, and whether the coveted result will be as completely attained as in the soft tints of the wild silk, the product of the same country. Of course opinions differ on this point, but at present they are only foregone conclusions arising out of other conditions of material.

The silk is said to be found "from the north-west range of the Himalaya, south as far as Midnapore, in Bengal and through the north-east range to Assam, and southward to Chittagong, and probably further. It is found also in the residencies of Bombay and Madras. "It is also stated to be abundant in Bhagulpore, in Bengal, and in the eastern district of Chattattisgaib, the Chanda district of the Nagpore province, and the home district. It appears that this special kind of silk has not been much dyed, but the evidence of the examples in the Exhibition proves that it is capable of taking colour in a very special manner as regards harmony to tint, and this fact has to be steadily borne in mind, as it may influence the whole result commercially. The "Tussore" raw silk has a very peculiar natural tint, which may be described as a greyish drab. This may have much to do with the peculiar subdued tint but wonderfully clear colour of the material when dyed, and the whole quality of the chromatic scale as dyed may depend for its harmony upon this peculiarity of the raw silk.

At all events the display of this "Tusseh," or "Tussore," by the India Commission is well deserving of every attention by those interested in the silk trade of Europe, and we have thought it worth while to call special attention to this unpretending, but in its economic aspect, very important illustration of peculiarly native products of our Eastern possessions. The fact that it is grown on so extensive an area, as also that the worm will feed upon a considerable variety of plants are all elements in its future commercial success. As might be expected, the want of fineness and high quality has hitherto been largely owing to an imperfect and unskillful method of manipulation throughout, from the cocoon upwards; and there can be no doubt that with the introduction of proper machinery, and the instruction of native growers, a corresponding improvement will be the result. This improvement is fairly illustrated as regards quality, fineness, and cleanness, in some of the specimens shown, and evidence is given that "Organzine" and "train" of good quality can be produced, and finally woven into a very considerable variety of fabrics in which it has until now been the custom to employ mulberry-grown silks only. There is another interesting and valuable feature of the economic value of this wild silk. The immense improvements made of late years in spinning machinery in England has rendered unwindable and waste silk available for a great variety of purposes, since an even thread is producable from cocoons which formerly were utterly useless. There is, therefore, every prospect that the cocoons of this Tussore silk, which have been rendered unavailable by the premature escape of the moth, can all be utilised and spun for a great variety of purposes.

Specimens of another kind of wild silk—three moths and six cocoons of Attacus Cynthia—were also exhibited. The silk is known in India as Eri, or Eria of Assam. The filament is very delicate, and the natives spin it by hand, like cotton. The yarn is made into a coarse kind of white cloth of loose texture, but great durability; in fact, a lifetime is not sufficient to wear it out. The winding of this Eria silk is stated to have been recently accomplished, but the filament is very fine $\frac{1}{3800}$ of an inch. We cannot but think that a most important future is opening, for the silk districts of India, alike in their wild varieties and in the mulberry-grown silks of Bengal which find their way into the European markets, and by improved machinery have been so largely used of late years. Nor must the fact of the introduction of the native dye stuffs in connection with the native-grown silk be overlooked, although this appertains rather to the artistic side of the manufacture than to its merely commercial aspect.

CINCHONA.

CINCHONA CULTIVATION IN INDIA.

THE introduction of cinchona cultivation into India was undertaken with the object of ensuring a cheap and unfailing supply of the febrifuge for the use of the millions who annually suffer from fever.

Fever is by far the most prolific cause of death in India, carrying off very many more than all other diseases and accidents put together. The total number of deaths from fever in India is upwards of a million and a half annually. At least half these deaths will eventually be prevented by putting some cheap form of the cinchona alkaloids into every druggist's shop in the country at one rupee per ounce; and thus multitudes will be saved from death or grievous suffering.

The successful introduction of cinchona cultivation into India has been a task of considerable difficulty in all its stages. It was not only necessary to transplant a genus of plants from one side of the world to the other, it was also an essential element of success to convert wild into cultivated plants. This involved a close study of the climate, soil, and general physical aspects of each region where the valuable species grow in their native forests; a comparison of these circumstances with those prevailing in the East Indies, the discovery of the best species, and also of the species best adapted to secure good results in their new homes, the study of all the requirements of the plants under cultivation, without any guide, as the cinchona had never before been cultivated; and finally, the solution of numerous very complicated questions relating to the best and cheapest form in which the febrifuge can be provided for general use.

The task was difficult and complicated. Mr. Markham undertook it in 1852, and all arrangements connected with the collection of plants and seeds in South America, and their conveyance to India, have been made by him, and carried out under his superintendence. His original plan was to depute collectors to the different regions of the Andes where the various species flourish, to have the collections made simultaneously, and to convey them direct across the Pacific to India in a special steamer. But only a portion of his

scheme obtained sanction, and no steamer was provided. He was, however, determined that all the species should be secured eventually, and that the work should be complete, even if it extended over many years. This has been the case. It has taken many years to do what might have been done in one or two, and the expense has been quadrupled. Yet the whole work is now at last complete.

In 1859 Mr. Markham was only able to organise three expeditions; one under his own command, to obtain plants and seeds of the calisayas and other species from Caravaya in Southern Peru, yielding the yellow barks of commerce; a second, under Mr. Pritchett, to collect species in the forests of Central Peru yielding the grey barks of commerce; and a third, under that eminent botanist Richard Spruce, to collect plants and seeds of the *cinchona succirubra* in the forests of Ecuador, yielding the red bark.

In 1860 the whole of this work was done and done thoroughly, so far as the difficult and dangerous part of it in the Andean forests and the conveyance of the plants to sea ports on the coast of the Pacific, were concerned; but the failure to furnish the means of direct conveyance to India led to disasters which were inevitable. The plants had to be conveyed across the Isthmus of Panama, then to England, then cross Egypt, and down the Red Sea to India. The first instalment from Southern Peru all died on the passage, or after reaching India; but the seeds forwarded in the following year germinated, and thus a stock of *C. Calisaya* trees was secured. Subsequently more seeds from Bolivia, collected by Mr. Ledger were received, and the plants raised from them have proved to be an exceedingly valuable variety, which has received the name *Ledgeriana*. The second instalment of plants consisting of those yielding grey bark, was equally unfortunate, but the precaution had also been taken of obtaining seeds from which a stock of plants yielding grey barks was established in India. The third instalment, coming at a cooler season for passing down the Red Sea, was more fortunate. It consisted of plants of *C. succirubra*, yielding red bark, nearly all of which arrived safely. Thus by 1862 the arrangements made by Mr. Markham as regards the above species were crowned with complete success; but the work of introducing all the best species was still far from finshed. It remained to obtain the valuable species from Ecuador, yielding the crown barks, and also the renowned species of Columbia.

Accordingly Mr. Markham obtained sanction for the despatch of a collector to Cuenca and Loxa in southern Ecuador to obtain seeds of the *C. officinalis*, the orginal species of Linnæus (afterwards called *C. condaminea*,) from the bark of which the Countess of Cinchon was cured. For this service he selected Mr. Robert Cross, an experienced gradener, who had already acquired experience under Mr. Spruce, with instructions to obtain a supply of seeds of the best Loxa species yielding crown bark. Mr. Cross reached Ecuador in 1862, made a good collection in spite of extraordinary difficulties, and the seeds arrived safely in India and Ceylon, and germinated freely. Mr. Howard, the well-known quinine manufacturer, also presented a fine plant of *C. officinalis* (von *Uritusinga*) from which a large stock has been obtained. Thus the introduction of the crown bark species was secured.

Mr. Markham's next care was to obtain and introduce plants of a valuable species called *C. pitayensis*, which grows on the slopes of the Central Cordillera of Columbia, near Popayan. For this working he again secured the services of Mr. Cross, who set out in 1863 and made a good collection of seed, but, owing to damage suffered in their transit, they did not germiniate. After some delay Mr. Markham obtained sanction for a second attempt, and in 1868 Mr. Cross again set out for Columbia, this time with more fortunate results, for seeds of *C. pitayensis* collected by him near Popayan arrived safely, and germinated freely in India.

Meanwhile the destruction of *C. pitayensis* in its native forests led the collectors to seek for other trees in more distant regions, and a new bark began to appear in the market, of great value, known as the *Calisayade Santa Fé*. Mr. Markham resolved that this species should also be introduced into India. The service was one of special difficulty and danger, for the trees are only found on the eastern Cordillera of Columbia, near the sources of the Cagheta. He again intrusted the work to Mr. Cross in 1877, and again his confidence in that intrepid and most able explorer was justified. In March 1878 Mr. Cross arrived at Kew with a good supply of plants of the *Calisaya de Santa Fé* and also of the *C. cordifolia*, yielding the Carthagena barks of commerce.

Thus at length all the valuable species of febrifuge cinchona plants, indigenous to South America, have been successfully introduced into India. They are as follows: -

C. Calisaya (yellow barks) Bolivia and Caravaya.
C. nitida, *C. micrantha*, *C. Peruviana* } (grey barks) Central Peru,
C. succirubra (red barks) Ecuador.
C. officinalis (crown barks) Ecuador.
C. Pitayensis } (Pitayo bark) } Columbia.
Calisaya de Santa Fé, *C. cordifolia* } (Carthagena barks) } Columbia.

The first and most hazardous stage of the enterprise was the collection of the plants and seeds in South America, and their conveyance to India. The second equally difficult stage was the cultivation and the discovery of the species best suited for India, as well as the best method of treatment with a view to producing the largest percentage of febrifuge alkaloids in the barks.

The first step was the selection of the most suitable sites for the plantation, being those having most resemblance to the native habitat of the cinchona. Mr. Markham proceeded to India in 1860 to perform this duty; and chose a site at Neddivuttum, on the northern slopes of the Neilgherry Hills, facing Wynaad for the plants of *C. succirubra*, the *C. calisaya* and grey barks; and a site at a greater elevation, under the Dodabetta peak, for the *C. officinalis* plants. He also selected sites for plantations in Coorg, and the Pulney Hills, and on the occasion of a second visit. to India in 1866, in Travancore and Wynaad.

The successful conversion of the cinchona from a wild to a cultivated tree is due to the unrivalled skill and ability of the late Mr. McIvor, superintendent of cinchona cultivation, in the Madras Presidency. Mr. McIvor propagated the plants with great success, established them in the plantations, discovered the conditions under which they would give the largest yield, and also the method of renewing the bark by the mossing process, which undoubtedly secures an increased percentage of febrifuge alkaloids. The final conclusions are that the *C. succirubra* species is best adapted for use in India, and for furnishing abundant supplies of a cheap febrifuge while the *C. officinalis* and the Columbian kinds will be the most valuable barks for the London market, and for the securing a remunerative return on the outlay. By 1870 the Neilgherry cinchona plantations, belonging to the Government covered 1,200 acres of ground, while private individuals possessed several thriving and paying plantations on the Neilgherries and in Wynaad, 235,747 plants having been distributed up to 1875. In the same year there were over a million cinchona trees in the Government plantations.

In 1862 a cinchona plantation was established in British Sikkim, under the superintendence of Dr. Anderson; plants, of *C. succirubra* having been obtained from the Neilgherry hills. Other kinds are not likely to flourish in the Sikkim climate, but the *C. succirubra* is well established in the Rungbee plantation. By the year 1875 there were upwards of two million plants of *C. succirubra* at Rungbee, and the propagation can be carried on with ease to any extent.

Thus the second stage of the enterprise, namely the cultivation, was crowned with complete success.

The third and most important measure is the supply of a cheap febrifuge to the people. As soon as it was established that the *C. succirubra* would be the best species for India a very critical point arose. That species yields a very large percentage of total febrifuge alkaloids, but only a small quantity of quinine. Mr. Markham saw that it was of vital consequence to discover the medicinal value of the other alkaloids, namely cinchonidine, quinidine, and cinchonine; and to ascertain whether they, equally with quinine, possessed the precious febrifuge qualities. He accordingly obtained the appointment of Medical Commissions in 1866 for each of the three Presidencies, to investigate and report upon this question. The result was that cinchonidine (the principal alkaloid in *C. succirubra*) and quinidine were found to be quite equal to quinine, and cinchonine inferior, though still efficacious in larger doses. This was a great point, for it made a cheap febrifuge medicine possible. The extraction of pure quinine is an expensive process, but the production of a medicine containing the total alkaloids in the bark is easy and simple.

This important fact having been established, Mr. Markham next urged the adoption of cinchona cultivation into India; namely, the preparation of a febrifuge medicine at the Government plantation, which should contain all the alkaloids, and should be saleable at a cheap rate. With this object Mr. Broughton was appointed as quinologist on the Neilgherry Hills in 1866; and in 1873 Mr. Wood received a similar appointment for the Sikkim plantations. Mr. Broughton adopted a method for the manufacture of his medicine which entailed the use of alcohol and was, therefore, too expensive. Up to 1873 he had made about 600 lbs. of an amorphous cinchona alkaloid, but the essential requisite of cheapness was not secured. His method was consequently abandoned. Mr. Wood began his actual manufacturing operations in 1875. His method is the same as that recommended by the learned quinologist of the Hague, Dr. J. E. De Vrij, who calls the resulting product *quinetum*. The powdered bark is first exhausted with cold acidulated water, and the resulting liquor is precipitated by a caustic alkali. Scarcely any fuel is required and no expensive machinery merely some wooden tubs and calico filters. There can soon be yielded, by his process, about 140,000 ounces of an efficient cinchona alkaloid every year at a cost of less than one rupee per ounce. Quinine, in England is from eight to nine shillings an ounce, and in India the price is much higher.

Thus the great object of this difficult undertaking is on the eve of being secured; and an inestimable blessing will be conferred upon India; while at the same time the barks rich in quinine will be sold in the London Market, and will repay all the outlay with interest. The sum of £40,000 was realised by these sales in 1877 alone. While on the one hand, cinchona cultivation will be a most remunerate public work, on the other it will rob the malarious fevers of India of three-fourths of their victims, and will to that extent diminish the amount of human misery and suffering.

G. B.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA : TUESDAY, 1st APRIL, 1879. [No. 4.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS :

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

WILL F. L. kindly send his address to the Editor who has a communication to forward to him.

LETTERS TO THE EDITOR.

ARTESIAN WELLS.

SIR,—May I request you, or any of the readers of your valuable journal to be kind enough to give the public some information regarding Artesian wells, which have, I hear, been constructed in Pondicherry, Madras Presidency; such as the cost of their construction, and the feasibility of constructing them in the Madura district.

INQUIRER.

Dindigul, 1st March 1879.

INFORMATION WANTED.

SIR,—Will you kindly permit me to put the following questions, the solution of which would put me and my country under your highest obligation.

1. What are the best means, natural as well as artificial, to obtain a large quantity of gum and lac from such trees as are capable of producing them.

2. Which trees or rather which kinds of trees can be best propagated by cuttings, and which by seeds?

3. Would you recommend liming a soil extremely sandy? Certainly not.—ED. *I. A.*

R. S. R.

10th March 1879.

INDIAN AND AUSTRALIAN WHEAT.

SIR,—I have had special opportunities of seeing various cereal grains lately. I find that the wheats exported from India are full of filth from the mode of threshing. They are also mixed with vetches and barley. In striking contrast to the Indian wheats, I find that the wheat from South Australia is perfectly clean. It is cut there by a machine called "Ridley's reaping machine." This implement will work only when the wheat is well ripened and dry; but those conditions are generally met in the N.-W. P., at any rate after the sun has caused the dew to evaporate. The machine simply cuts off the ears and extracts the grain from them as it travels along. I am convinced that if it can be adapted to bullock labour, the introduction of this machine would prove a great boon to upper India and Scinde. It would get in the corn free from the dirt of the "kunnun," and would moreover leave the low growing pulses untouched. Of course if the villager sows "goojai," the machine would turn out goojai. I merely give you the hint for what it is worth, but I hope that some enterprising zemindar or official will prosecute enquiries from the Government of South Australia. If Indian wheats were reaped like Australian wheats, they would bring a far higher price than they do in the English market. The machine I write about is made in Australia, and I have not as yet been able to discover a single specimen in England; but if any of your readers interest themselves in the subject, I shall be very happy to assist them in making further enquiries.

H. MIDDLETON ROGERS, LATE B. C. S.

20, Corn Exchange Buildings, London.

DETERIORATION OF TEA SOILS.

SIR,—In the *Indian Agriculturist* for February 1st, 1879, there is a very clever and interesting report of Mr. E. C. Schrottky, on the subject of Kans Grass in the Banda district, in which he states :—

"If Kans has taken possession of any field and is left alone, it "exhausts itself after ten to fifteen years' continuous growth (or rather "exhausts in that period the peculiar elements in the soil which support it). If, however, the soil is disturbed or cultivated, Kans will

"last longer (that is to say, when atmospheric and climatic influences "are allowed to act more freely upon the soil, by stirring it up, there "will be set free from chemical combinations some more of the peculiar "elements, Kans is partial to and the additional nourishment thus "furnished, will prolong the existence of Kans beyond the usual period)."

The above exactly represents the present state of the case as regards tea cultivation—"the peculiar elements in the soil which support the tea-plant are being exhausted" from over-plucking; and although manuring is largely carried out on many gardens the exhaustion above alluded to is but delayed, not prevented; which can only be neutralised by giving the plants a rest, and allowing them to mature their "flush" leaves, say, once in four years, letting the natural vegetation of the place grow in its own natural luxuriance, mature its seeds, and die down, after which dig it all in and carry on the cultivation in the ordinary manner.

It may be said that shareholders will object to losing their dividends every fourth year—better this, though than not obtaining any for half a generation, or perhaps for ever. Still matters need not go this length, but may be avoided by plucking annually fr m only three-fourths of a plantation leaving the other fourth fallow and thus give the plants rest onc f r years, and allow them to [illegible] and r [illegible] their seed and to be in [illegible]atural a state as it is pos[illegible] le for a cul tivated economic plant to be.

The present system of continuous plucking of th new le [illegible] resembles the operation of killing the goose that laid the golden eggs Assist Nature and she will reward you, try to force her and punishme t will surely ensue.

G. P. P.

KANS GRASS.

I.

SIR,—I was much interested in reading Mr. Schrottky's on Kans Grass, in the *Indian Agriculturist* for February 1st. Having been at Jhansi in 1874, where we had relief, works, in consequence of the distress it produced, I came across a good deal of kans and was very much struck with the phenomena which attend its appearance. My attention has been a good deal drawn to Agricultural Physics since leaving Jhansi, and after thinking out [illegible] matter, I felt s[illegible] sfied that the appearance of Kans signalized the exhaustion of the soil in a manner about which there could be no mistake. I observe Mr. S. states "that injudicious exhaustion of the soil is one of the causes of its appearance." In fact the then Commissioner of the district told me at the time, and a native cultivator complaining to me of kans also admitted the fact that [illegible] the people tilled and manured their land, they got the Kans down, but I am afraid, it will be no easy matter to get such a measure as this enforced as a matter of public safety. Having occasion to look through a set of analyses of Indian soils abo[illegible] two years ago, I came across one of a soil in the native State of Tehree which joins on to Jhansi, and is close on th[illegible] Kans devastated tract, but not so far as I have seen, as yet affected. Comparing this with the other soils, I was struck with the small amount of sulphuric acid present and pointed this out to Mr. Harman of the Mysore Agricultural Department, who considered the matter worth noting. I remark the same thing in Mr. Schrottky's analysis of Banda soil. Potash, soda, chlorine and sulphuric acid, together, only amount to 0.56 in No. II overrun field, wh[illegible] in No. I they are 1.28. So that the sulphuric acid must be a mere trace. Now it is curious that in Mr. S.'s analysis of Kans ashes there is only 0.8 per cent. in the plant. Turning to the tables in Mr. Schrottky's *Principles of Rational Agriculture* I notice that most of the useful plants require a very much larger proportions than this annual rye grass for instance, as much as 3.45 per cent., wheat straw 3.6[illegible] rye straw is the sole competitor with Kans for the short commons of 0.8 per cent. Indeed I once made a formal allusion to the Jhansi famine caused by Kans and with some diffidence suggested that an analysis I had seen, indicated the absence of enough sulphuric acid as the promoting cause of Kans. I also stated broadly my impression that the grass betokened that the land was exhausted, and t at as far as I had seen there was nothing to prevent its appearance o[illegible] the entire adjoining districts in time. I see in Johnson's *How Crops Grow*, an American book, that in the oat plant SO_3 exists much more in the leaves than in the stem, and that on blossoming apparently the sulphuric acid deserts the lower joints of the oat stem entirely. Now my recollection of Kans is, that it has the appearance of animated straw when growing, there being little green leaf about it, so that it is by constitution a plant, which might be expected to contain the minimum of sulphuric acid.

P.S.—Lime as sulphate.

In Tehree soil	... ...	0.602 per cent.
„ Lower Bengal soil	... ...	0.414 „

No other sulphates in the analyses.

A. T. F.

II.

SIR,—Having read Mr. Schrottky's report on the weed called *Kans* in the local *Gazette*, I take the liberty to express my own theory and thoughts on the subject. They are based solely on practical knowledge of the soil. I am a land holder of a few villages in the district. Mr. Schrottky's remarks on the causes of its growth are learned, mine are vulgar and purely rural. If you consider these few lines worth anything, you may kindly insert them in some corner of your valuable paper.

Kans is a weed which grows particularly in *mar* and *caber* lands, and seldom in rich *pundwa*; but is almost unknown in *ranker*. The former two are considered the rich[illegible] soils for cultivation and the latter are light ones.

Irrigation and manuring are almost unknown in the district. Farmers solely depend on rain and air. They do not plough deep, nor more th[illegible] once, but [illegible] w the seeds in big clods. When they have extracted from the soil, element[illegible] pe[illegible]liar for the growth of certain crops without changi[illegible] [illegible]en.. and the d[illegible]ficiency is not supplied by any artificial mea[illegible] [illegible] mes impoverished, and must needs have recourse to some natura[illegible] [illegible]nod. [illegible]hen the land is exhausted or when those fructi[illegible]ng elements are washed away by heavy rains, this weed must grow up. [illegible] reason why this weed has such long roots, I think, is because the soil was full of those elements, but when they have become extinct on the surface, they still exist under it at a certain depth. It is a natural means to pump up those elements to the surface of the soil by capillary process, and when it has performed its functions it dies a natural death.

This is a very slow process, but at the same time a most certain one, which very often takes seven years to perform. Now it is the business of an experienced agriculturist and practical chemist, to invent and introduce a more steady method. It must at the same time be a cheap one, otherwise it will be of no use, more especially in this poor district. I know nothing of phosphoric or any other acids, because I have no means to analyse the soil, nor have I a sufficient knowledge of chemistry. I may venture to state a vulgar method which may suit the means of the poorest class of farmers not quite unknown to the people at large of Banda district. If the cattle are kept feeding on the fields, the *kans* will not grow, and if the soil is already infested with the weed, it will vanish sooner

There is another method which I mean to try next season—and which if proved successful may still be a more expedient method. I mean to make ditches around the field and to have a sort of embankment round them, in order to pr[illegible]vent the water f[illegible]m running away. This must be in addition to the above process

These are my own thoughts, I have never had an opportunity of reading those treatises named in Mr. Schrottky's report.

A FARMER.

Band[illegible] [illegible] 1879.

N[illegible] [illegible] tion to the above experiments, why does "a farmer" not *sow* a portion of the Kans infested land, as recommended by Mr. Schrottky. —ED. *I. A.*

BAMBOO.

SIR,—I find that in my last letter to you of the 23rd January, I omitted to call your attention to the last report I received from Mr. Robert Thomson, page 27 of the brochure I sent you at that date.

The letter you published from me in your January number, gave the matter of my communication to the Secretary of State for India, therefore I assume you would not repeat that portion of my print.

I now send you copy of extract from the Demerara *Royal Gazette*, January 9th, which perhaps you will see well to insert, as it bears on the point of growth, produ[illegible]ion, and cropping of the bamboo, and *cæteris paribus*, there should be no reason why what dame Nature effects in the West Indies should not likewise be obtainable in the East Indies.

Extract from the *Royal Gazette*, Demerara, West Indies, January 9th, 1879.

Regarding the local [illegible] of bamboo so strongly advocated in his letter to Mr. William Walker (which we publish) one of our country readers writes thus —"Demerara is not specially suited for "bamboo unless the plant has good drainage and plenty of room. In "the [illegible]ward Islands where it has both, it grows to a gigantic size; "but here it is a poor [illegible]ing. The low lands abutting on the sea are "not good for it, as they are salt, and undrained; bamboo blossoms "even when it has been cut for firewood the year before, I have seen "it several times, the stools did not die, probably because the stalks "were not too old, and were succulent and healthy. At an estate I was "on, we had large quantities, and every [illegible] were cut clean of, "and close to the roots, and the next [illegible] had *the same supply*,

"say 1,000 cords of fire-wood. Every body knows that the way to "plant bamboo is by the cutting. If the soft stalks only are required "for paper, *two cuttings a year* could easily be got ; in 12 months the "stalks are hard and good for fire-wood or for making sub-soil drains ; "the young shoots say 6 or 9 inches long (as they come out from the "stool, after a cutting especially) make a delicious pickle made ... like "walnut, or cabbage, or paw-paw, &c. Why cannot the R. A. and C. "Society give a prize for an *essay written from an actual knowledge of "facts*? It is a fallacy to suppose that bamboo is going to grow either in "a swamp, or a hard, dry, and perhaps salt pasture on the front lands. "It *must be* well drained, kept clear of bush, and have water, not "stagnant water, but good rain or running water," My correspondent in Demerara (an estate-holder who sent me the above extract adds "I have seen on this estate clumps of bamboo ... and ... "remained quite health, afte..rds, I have cut them down flat to the "roots, and also burned them, but in a few months they were as "flourishing as ever."

The above assuredly does not coincide with Dr ...'s experiments ... *possibly*, the variety of bamboo may have ... the reason, or the age of the clump, as an aged ... of bamboo, like an old man may lose its vigour of ... Dr ...'s experiments were conducted on clumps of *Bambusa* ... the variety of bamboo indigenous to Demerara I believe to be *Bambusa* ... probably however the reason may have been climatic influence, insufficient moisture, at any rate cutting down the whole of the shoots both old and young should I think be avoided.

THOS. ROUTLEDGE

Claxheugh, Sunderland, 20th Feb. 1879.

BEE-CULTURE.

SIR,—Your valuable paper has often ... inted with reference to bees, and the advancement of bee culture. I write the following as regards the wild honey-bee of the sub-mountain tracts that have come under my observation.

There are but two descriptions of wild honey-bee in these parts, but natives of Oudh tell me, there are four in their country.

1.—Punjabi *Bhardo*, Oudh, *Sar...ng*, a honey-bee exceeding half an inch in length, head and thorax black with greyish yellow hairs at its base, the whole form elegantly symmetrical, the abdomen orange-yellow longish, the white and black bands or segments not distinct, the extreme segment forming stinging apparatus blackish wings metallic and blackish. They are very fierce, and if disturbed will swarm out and put all to flight w... a considerable ... they ... settle down again. I have ... will ... to the extremity ... was once to ... still, attacked ... to breathe, they left ... a stout branch of a ... never broad, so that the ... from ... They a... under the eaves of houses and ... so that they are ... of domestication, for it is said the ... will species No. 1, ... the hollow of trees. If not irritated they are harmless, and the ... be obtained by smoking, generally at night. The ... yellowish, and the wax ... England, in the Stabau bee ... honey ...

No. 2, Punjabi *Chota makhi*, Oudh *S...*, This is a small ... not even half the size of the last, it is ... colour, the white and black bands, four or five, very distinct at lower part of abdomen, wings ... parent, very light grey. It is a very harmless creature and not ... Their honey is very fine and white crystallizes in winter. The hive is not very large. The habits the same as above. ... geological pastime in the salt range, a native ... a few steps off the road having ... Both these varieties are very plentiful ... since fruit and forest trees abound, ... requires food for them to ... hills the Chachura, the white ... to draw them.

No. 3. Punjabi *Dhamala*, Oudh ... No. 2, the hive largish. Honey ... domestic bee of the Kangra and Chumba h... to ... bee hives formed in the shape of a drum with a ... as would be the better description, they place ... and have the holes outwards, generally ... with ... when they extract the honey from the ... smoke them out; they transfer them at the swarming season by smearing some sweets in a new hive ; the people only feed them in the winter when the snow interferes with the bees resorting to wild flowers ; the food is then a parched grain (*seinul*?) with gur. The plentiful wild flowers, especially the Labiatae, are sufficient to feed them.

No. 4. No Punjab name, Oude *Bhusami*, this is a trifle smaller than No. 2, and may be the true representative of the wild bee, for it builds in the hollow of trees. It is darkish of colour. The honey is somewhat tart.

A French *savant* in a monograph on bees, states that bees were originally brought to Europe by the Arayan races, for they were not indigenous. Bees and honey form a portion of the offerings at the "Hum" sacrifice. I find in the Vedas, and even now are used at "shraddas," but as to their having been carried to Europe by the Arayans is an open question. Perhaps it is so, as the cereals were also taken by these people when migrating. But bees are wild in the hills of India, and my getting ... in the salt range, brought to my mind the times of John the ... It is probable that bees, cereals, &c., formed a portion of the ... old, belongings of the Caucasian races and were carried by them ... they ... settled in.

It is well known that bees were unknown in North America ; the Red Indians ... "English fly." Now bee culture is a very important branch ... in several States, and tons of honey are exported to England and thousands of acres cultivated with flowers ... community doing nothing else. There is no ... here also, and need not be confined to the ...

W. W. BUCHANAN.

Guzerat ... March ...

HILL FARMING.

(*Extract ... Madras Mail*)

SIR,—In estimating the capabilities of ... district for meat producing, its suitability for the growth of turnips ... highly important matter. Turnip growing, and the use of bones as manure quite revolutionised the farming system of England, and according to competent authorities, about trebled the meat-producing capabilities of the country. A Yorkshire Farmer writes, "Bones form one of the most valuable manures for turnips on all light soils, on account of their portable and stimulating character, they have converted barren moor lands into rich fertile, and productive farms, luxuriating in every valuable product of the country, their value is beyond all praise." Another writer, says, "All comparatively dry soils, from the poorest sand and gravel, up to the richest free loams, are more or less suitable for turnips."

These two short extracts show us exactly what could be done to bring the Hills into a condition for producing meat. We have exactly the soil required, not in patches as it is found in England, but the whole cultivatable area of the Hills is what in England would be classed as "turnip soils." The apparent difficulty is its poverty, but the grass lands of the Hills are not naturally poor, they have been ... by being grazed over for generations, and receiving nothing in return, not even the droppings of cattle, for that is washed away by the first heavy rains but it was found on the farm that the grass ... was equal, if not superior to sholah land. All that was required was a heavy dressing of manure to bring it into condition. The difficulty to be faced was the getting manure to start with, but with bones as a manure the difficulty can be got over. The great advantage in using them is their portability ; sixteen bushels is ... calculated to be sufficient for an acre against thirty cart loads of farm yard manure, and once having brought the land into condition and stocked it, the up-keep becomes easy.

Now, let us draw a comparison between the Hills and England as turnip growing countries. In England there is about a month and a half during which turnips can be sown. Only one crop a year can be raised, and these have to be raised, and stored during the winter at considerable expense, and heavy loss from decay ; and perhaps not more than half the land in the country is suitable for the growth of the root.

Here every acre of land is suitable, and *planting can be carried on all the year round*, and consequently a regular supply can be kept up without the expense or risk of storing. There is a difficulty with young plants during the dry season, chiefly from the attacks of fly, but there are ... lies for this, besides there is little necessity for carrying on ... during the dry months, *the roots will stand on the ground ... damage for two years.* I have kept mangolds and beets on the farm land until they were two years old, and they were then quite sound, and weighed as much as forty pounds each.

The turnip, too, seems to accommodate itself to almost any elevation. I have seen them growing freely at Manantoddy, and they thrive at Bangalore, and at the top of Dodabetta.

I have written at this length on turnips, because I consider them the very back-bone of stock keeping, and if it is proved that the Hills are favorable for their growth, it is proved beyond dispute that it is, or

could be made a good meat-producing district. It may be said that turnips are not all that is required. Neither is it; we want fodder and cake. The latter I have already spoken of, and also grazing for store cattle. We still require fodder for fattening them. Here is what an English author says on the subject, "a cow or ox requires from two to three acres of pasture or meadow to feed it all the year round, but by raising clover, lucerne, saimpoar, or tares, three cows or more can be fed with the produce of one acre," and this, where for six months in the year growth is almost at a standstill, whereas here, with land under irrigation, growth goes on all the year round, and all the varieties mentioned thrive luxuriantly. Notwithstanding all this, we get on our tables quarters of mutton (?) of four pounds, and the remains of superannuated bandy bullocks

Reader, with a delicate stomach, do you purchase your own meat? If not do not venture on it. It is said that his Satanic Majesty provides us with cooks, and certainly some Demon, who presides over filth sends us our butchers. I should imagine they offer a premium for the dirtiest coolies they can find, to carry their meat to our doors. It is carried on a tray that has carried generations of bandy bullocks, without the purification of scraper or scrubber and is usually covered with a cloth that bears unmistakable evidence of having done duty as an article of dress. I see this, and still, thank God, for my daily food, but oh! how I would thank the man who would start some establishment from which I could obtain a well fed joint of meat, free from the abominations of filthy cloths and unwashed paws.

J. BARNARD.

KOTEGHUR NOTES.

SIR,—The weather has been extremely dry during this month: about half an inch of snow fell on the 15th, rain on the 20th and 21st, and a small quantity of hail on the 22nd, the whole barely sufficing to penetrate more than four or five inches into the soil. This dryness will stunt the wheat and barley, causing a loss in straw from the halms being so short.

The following is a comparative table of the past five seasons:—

	FEBRUARY.				
	1875.	1876.	1877.	1878.	1879.
Snowy days ..	8	[illegible]	5	1	1
Haily „ ..	..	..	1	6	2
Rainy „ .	2	6	1	[illegible]	2
	Damp and cold	First half fine, second half damp and cold.	Cold and damp. About 27 inches of snow fell	Mild at beginning, cold towards end.	Mild and very dry. Hardly half an inch of snow fell.

Wind at beginning of the month W. then veered to the N.-E.

Thermometer (Fht.), hung in open verandah W. aspect, about 42° in the morning, 50° in the evening, lowest 35° highest 51°.

Jungle-burning is still going on in those places where the villagers have more grazing ground than what they know what to do with. Where the grazing grounds are cropped for hay or eaten down by cattle and flocks these jungle fires never occur, it is only where the villagers have such a superabundance of grazing land that they cannot make use of it for their flocks and herds that they burn it: in Australia one acre of grazing land is reckoned ample to feed an animal all the year round.

The bark of the branches of the Kail trees (*Pinus excelsa*), in many places, has been covered with a kind of manna (vern. *Mereh*), it is sweet to the taste and is much liked by the inhabitants who go out in parties to obtain it, believing that good luck will ensue on eating it. It appears at long intervals of time and is said to betoken a hard winter and a season of scarcity. It comes out between the months of November and February. The last time it appeared was in November 1871. The Catkins of the willow (*Bushal, shun*) have budded, buds of the Andromeda ovalifolia (*Elan, erana*), wild pear (*shegul*), peach (*aru, beimi*) are swelling: plum trees (*alucha*) are now becoming covered with their pretty white blossoms, smelling so sweetly. Of wild flowers there are the rock lychnis (*d[illegible]mbú-lan*) with its red flowers; the violet coloured primrose (*fanting[illegible]*); and a small white flowered plant somewhat resembling the scented allysum in gardens. maiden-hair fern in warm moist situations.

The thrush (*bh[illegible]ru*), and starling (*[illegible]alar*) dart out of and about the hedges busy hunting for grub owls have come out from their winter resting places and bats also, the former are heard hooting in the jungle. The monaul, argus and other snow birds are now migrating (earlier than usual owing to mildness of season) to higher parts of the hills keeping just below the snow line; they are still tolerably tame. Hare hunting should now finish and the animals be left alone to mate, breed, and rear their young ones.

Food grains are now about as follows, per rupee, atta 8 seers, wheat 10 seers, coarse rice 8 seers, table rice 5 to 6 seers, corn dall 9 seers unground, or 8 seers ground, millets and inferior grains 12 seers. The dearness of provisions though partly due to the dry weather, we have now had for so many months, may also be partly accounted for by the fact that the local Government native officials are largely landowners, having large stocks of food grains on hand, and that human nature—where self interest is concerned—being selfish, it is only natural to suppose that rates for the food grains and other produce are being and will be driven up to their highest possible extent. Government though perfectly aware of the circumstance of the local officials being large landowners, yet keep them in their present positions "because being large landowners it would be an inconvenience to them to be removed," at least that was the reason given by the chief European district official, in one well known instance for not removing the naib tahsildar, when his removal had been recommended by a magistrate sitting on the bench and recorded in a judgment! Fancy retaining an European Government official in his position under similar circumstances!

Some of the villagers in the adjoining native territory of Kanayti have taken to ploughing their fields since the rain fell, with the intention of sowing corn and *barley* as they could not do so last autumn, through having but few ploughing cattle and their fields—the ones now being ploughed—becoming so dry, owing to the drought, before they could set to work upon them that they had to forego doing so; they are now hoping to recover lost opportunities and think that the present sowings' will ripen about a fortnight later than if sown at the usual time. I shall endeavour to keep myself informed of this experiment, and, if successful, I will keep a spare field and do the same next year.

Gardening operations much the same as last month. Zinia, mignonette, dianthus, and other flower seeds sown. Scarlet-runners sown during first week, sprouting in the last week. Transplanting of trees and shrubs going on. The vine which was transplanted during the frosty weather, has split and died down nearly to the roots [illegible] of that its period of removal was a little out of season, cuttings of roses, willow, &c, have been made and planted.

G. P. P.

Koteghur, 28th February 1879.

AGRICULTURE IN THE SARUN DISTRICT.

I.

SIR,—A great howl is raised against indigo in North Behar for taking up from 200,000 to 225,000 acres of land "which would otherwise be devoted to the growth of food-grain crops"; but when the crops in millions of acres of the very land which is entirely devoted to the production of food-grain, fail, then follow wild shouts for canals; and, as the late Colonel Gorbet remarked, engineering is asked to step in to take the place of agriculture. Experience gained during the present season of drought, however, conclusively proves to me that the true remedy lies in the ryots' hands, if it is made worth their while to take advantage of it. When the crops are parched and stunted, the cry for water at any price arises, and canals are considered the only panacea to mitigate the effects of drought. There are few men connected with agriculture in India who have not been stricken with this crave for canals; it originates with the first burst of alarm, and I am afraid that many people will succeed in ruining themselves, and their lands, before they discover the mistake committed in introducing canals to their districts. The project which is now being carried out in the Sarun district, presents a striking proof of how irrigationists would like to convert the most simple scheme into an elaborate work. All that the district planters asked for was a supply of water in the small rivers, which are now dry, and if the work had been entrusted to the charge of a committee of practical men, it would have been finished ere now, at a cost of not more than Rs. 1,50,000 at the outside. But the scheme has grown until it does not know itself; symmetrical cuts are being made across high lands; so, besides the cost of these works, the Government will probably have to pay heavy damages for crops ruined in water-logged lands, for it puzzles me greatly to think how maize, indigo, and the superior cereal crops are to thrive with stagnant water rotting their roots two feet from the surface of the ground. As it is, the spring level of the district is too high in many places during the rains, and even now in the month of January, in the vicinity of this factory, water is eight feet from the surface in high sandy fields, and 4½ feet in the very paddy *chours* which have failed to produce crops for the last few years. During the time crops were in the ground, water was only three feet from the surface in these *chours*, and yet the upper layer of pure impervious clay was compact and hard like blocks of stone. The soil in these fields at the present season cuts up in large lumps like coal, to a depth of three feet, until sand is met. This impervious layer prevents air making its way

through the soil, and also prevents the water from below rising to the surface by capillarity. There are, at least, two million acres of these stiff clays in North Behar, and during seasons of drought it might be said of the roots of the plants growing in these hide-bound soils, "moisture, moisture, *above and below*, but not a drop to drink." These lands are at present too strong, that is too say they have a layer two or three feet deep of the purest clay, which has been gradually washed down for centuries by surface drainage from the high lands. To improve the physical conditions of these clays, canal water is certainly *not* required, they want either lots of bulky organic manures, burning, or an admixture of sand to render them porous and friable; I have recommended the latter-mentioned method to the Government as the most simple and practicable in this country, where I despair of ever seeing the natives apply their straw in a rational way to the fields. Sand can be procured from the subsoil of the high fields or even a few feet below the surface of these very clays. Surface drainage from the high fields should be checked by enclosing them with banks, and by *cutcha* wells sunk in the lower ends of the fields; this would prevent the rain water sweeping down and lodging on the *chours*, which, after being rendered friable by any of the methods proposed above, will then be fit to produce all the superior kinds of crops grown on the high lands. The paddy is never a thoroughly successful crop, as it either suffers from droughts or floods; besides, under the most favourable circumstances, it is not so valuable as the highland crops. For the last eleven years I have had considerable experience of paddy cultivation under artificial irrigation, as a number of the *chours* in the vicinity of my factory are irrigated by natural flow when the Gunduck is in flood; and I have particularly noticed that the crops in those *chours*, which have been under irrigation for a number of years, do not present the same healthy appearance as paddy raised in seasons of heavy rainfall. The plants, too, often get choked by weeds, the seeds of which are brought down in the river water. It will sound strange to English ears, that, in places where irrigation water cannot reach by natural flow, the paddy crops have failed, although spring water was only three feet from the surface; but such has been the case with thousands of acres in every season of partial rainfall. Again, in seasons of heavy rainfall, when the paddy *chours* are flooded with rain and canal water, the maize crops suffer in proportion, *as the whole country then is water-logged*. I remember in 1871, a year of heavy rainfall, thousands of acres of Indian corn suffered from excess of moisture, and consequently distress occurred among the cultivators in many places. In friable and well drained soil the roots of the Indian corn plant average in length 5½ feet. A good idea of the condition of the crops in high lands, during the rains, can be gained by a study of the indigo *khoonties* (or second growth) during the months of August and September. The heavier the rainfall is, the poorer these *khoonties* are, and this is a proof that even the highest lands suffer from excessive moisture during that season. In 1871, when 69 inches of rain fell during the rains, the indigo second growth was so poor at my factory that it took 9 *beegahs* 13 *cottahs* of plant to fill a vat; whilst in 1877, when the rainfall was only 18·25 inches during these four months, the average per vat came to 3 *beegahs* 1 *cottah* of plant. Some people are too apt to look upon indigo as a dye, forgetting that it is a plant which thrives or languishes from the same causes that affect the maize or other high land cereal crops, and therefore when I bring indigo forward as an instance, I am often met with the reply, "that may be the case with indigo, but not with maize or other crops."

A most serious evil connected with land in which stagnant water lodges, is, that as it dries, the soil settles in such a compact form that the roots of plants cannot possibly travel in search of food; hence we find, in seasons of light rainfall, the paddy burnt and withered, although water may only be three or four feet from the surface of the land. If we insist upon bolstering up the paddy, we shall do so at the expense of the superior crops on the high lands, for the paddy does not thrive unless the lands are in a water-logged state; and this will be most suicidal policy when we take into consideration the fact that these very paddy fields can be improved so as to bear twice, nay three times as much food-grain, as they do now under the most favourable circumstances. The undermentioned statement should be enough to show the difference between a rational and vandalic system of agriculture. Fields 1 and 2 are within a stone's throw of a village near my factory, they are only separated from each other by a narrow border. No. 1 Field is farmed by a resident in the village, who has a number of cattle, the manure of which goes on to the land; growing high, dry crops as a rule, and being near the village, it also receives extraneous manures. These organic manures have rendered the clay soil friable and porous, and it produced an average of 28 maunds of maize per acre during last *khurreef* season; and now bears a flourishing crop of barley and mustard, the produce of which is estimated at 19 maunds of barley and 9 maunds of mustard seed per acre. This field, at all events, has done its duty in producing within a twelve month 47 maunds of food grain and 9 maunds of mustard seed per acre, *all without irrigation*. Now, let us see what field No. 2 has done. Being a little lower than field No. 1, the soil, in consequence, is a stiffer clay, and is devoted to paddy; it is farmed by a ryot who lives in another hamlet, a quarter of a mile off, hence the field is never manured. Paddy was planted in it; and although there were forty wet days, during the time it was in the ground, giving in all 26·60 inches of rain, still the crop proved a failure, and produced only an average of 5 maunds of unhusked rice per acre. The field is now empty, a hard impenetrable patch, devoid of weeds or vegetable life. The other day, at the beginning of this month, I took a spade, and digging through the hard dry clay came to *water* 4¼ feet from the surface. Now what would have been the effect of flooding this field? It would simply have raised the spring level to such a height that the maize crop in field No. 1, would only have produced half the amount it did when the spring level was lower; in fact paddy field No. 2 would have been nourished at the expense of maize field No. 1. The yield of 3,854 lbs. of food-grain per acre is of course enormous, and can only be produced from continuously and highly manured land; but it shows what this glorious land is capable of doing under proper treatment; and the paddy field, although not capable of producing the same amount for want of manure, would, if drained and rendered porous and friable, give at least 2,000 lbs. of grain per acre, as we know how prolific clays are under fair treatment. The maize crops this last autumn were very fair on the high friable loams, and the succeeding crops of *rubbee* were equally good, *without irrigation*, wherever manure was thrown; although, of course, in unmanured plots they are stunted and sickly. But is irrigation to take the place of proper tillage and manure? God preserve the people if it is. It strikes me as being most inconsistent to talk of 200 or 225,000 acres of indigo land (as the case may be) being "the curse of the country," when over two million acres of the finest land in the province annually produce next to nothing for want of proper treatment.

D. N. B.

II.

SIR,—My old employer used to assure me that a planter does not profit by experience until he has lost a lakh of rupees; using the same style of argument I may say that the Government of Bengal will not profit from warnings frequently held out to it until another famine, like that of 1770, desiccates the land and sweeps away 30 per cent. of the population. It exercises me greatly to think, why the Government should persist in patching and bolstering up a system of agriculture which has everything against it, and nothing to recommend it. If the paddy was a rich and prolific crop, like wheat or potatoes, I could understand the anxiety to keep it on its legs; but considering that when it succeeds best, it is at the expense of other crops and the cattle of the country, I think that the sooner its cultivation is confined to the very deepest *chowrs* in the province, the better it will be for the people and the land. If the cattle, like Balaam's ass, could only speak, I am certain they would tell us that they prefer a bad paddy season to a good one, as they then get clean sweet straw to eat; whilst on the other hand when the paddy lodges in the mud and water, the ears of grain are cut off, and the coarse, dirty straw, which is unfit for stock food, is left on the field to be carried off for the mere gathering, free of charge, by the saltpetre and *khari* makers. The cattle would also give vent to their feelings, very freely, with regard to the wholesale exportation of oilseeds which goes on from this province. I have a large stock of bullocks at this factory, and I find it impossible to get a sufficient quantity of linseed cake for them, although I am living in a country where flax is grown in every *rubbee* field. Most of the linseed is exported to Calcutta and other large towns, like fish to London from the provinces. With poor and lean cattle to drag our ploughs, and supply nothing but thin watery manure, it is impossible to expect the agriculture of the country to flourish, and I therefore beg of the Government to place a heavy export duty on oilseeds, so as to check the trade. The argument against interfering with free trade is no argument at all in this instance, as I am asking the Government to protect a wretchedly poor and ignorant peasantry against themselves. The people must manure their lands, and introduce a proper system of rotation of crops, or they will perish in millions; nothing but a sound and rational system of agriculture can save them. The last two seasons of drought have not passed without shedding certain advantages, as they have in the most prominent manner exposed the weak points in native agriculture; a painfully severe lesson to the wretched masses of the people, but one which our Government should be prepared to profit by. An almost insane confidence is placed in the saving powers of irrigation canals and wells by the Supreme Government, instead of these accessories being looked upon as one of the minor props to the prosperity of Indian

agriculture. Supplying India with irrigation works, without making an attempt to improve the agricultural practices, is like dosing a man suffering from *delirium tremens* with a bottle of brandy; for a short period these works *may* act as a stimulant, but eventually the last state of the land will be worse than the first. I claim every right to write as an authority on this subject with reference to my own province, as I have had a little irrigation work during the *khureef* and *rubbee* seasons all to myself for some years, and the more I study its effect on the cereal crops and opium the less I like it, even the very paddy crop is deteriorating under artificial irrigation. In September a heavy flood occurred on the Gunduck, and a large tract of country was submerged for many weeks; as the water dried up, the fields were sown down in barley and wheat. I said to myself as the men were sowing their crops—now is my chance of observing the fertilising properties of the Gunduck silt; but the result is most disappointing, the crops are thin and stunted, and the average yield will not exceed six or seven maunds of grain per acre. Certainly the crops were late in being sown, still they ought to be much better than they are. If irrigation can take the place of the rainfall, why has it not saved the poppy crops in Sarun during the last two seasons? It is not for want of trying that the natives lost their poppy, as they have been slaves to their fields ever since these crops were sown, working at the wells and ponds from morning till night, and many fields have received five waterings and as many more careful weedings. There is one field which I irrigated for the owner by natural flow, before the seed was sown, and since then it has received two or three waterings from well water, but the crops is miserable in the extreme and will not pay its expenses. On account of this unnecessary hard work and poor return, the poppy is becoming a most unpopular crop with the cultivators; and the Government should take warning in time, and ask the planters to institute a series of experiments to see if it cannot be rendered less precarious, as certainly irrigation alone will not save it. I have not seen any of Mr. Scott's valuable notes on the subject, but my idea is that the poppy fields should receive bulky organic manures such as refuse of indigo plant, and top dressings of rape and mustard cake, the seed also should be sown in trenches to protect the young plants from the extreme heat during October and the beginning of November. The loss of the revenue derived from the opium industry will be more than the Government could bear at present; but if the seasons do not change for the better, or an improved system is not introduced, the poppy cultivation in North Behar will become a thing of the past; for surely the Supreme Government will not force the ryots to continue the cultivation of the crop at a loss. If the opium department, at the end of the present season, will publish a statement showing the number of acres under cultivation, and each ryot's account for the last two seasons, the public will be greatly obliged. The Government owes a great deal to the ryots of this province for the opium revenue, and therefore it should be prepared to go hand in hand with the planters in introducing an improved system of agriculture.

The district officers of North Behar show by their statements, regarding the prospects of the cold weather crops, published in the *Calcutta Gazette*, how little they understand why the crops are so poor, as every reason but the right one is given. One gentleman says that "the cold weather crops on unirrigated lands are stunted and thin" and another that "the *rubbee* crops are poor for want of rain." If good crops of barley and wheat, which are suffering from over luxuriance of growth, were not to be seen in every pergunnah in *manured* and *unirrigated* lands, one would chime in with the idea that irrigation was necessary; but these manured lands prove that all that is wanted, even in dry reasons, for the *rubbee* is organic manure in the soil. Certainly the *rubbee* is very poor in unmanured lands, "sick unto death" for want of sustenance; but the manured and unirrigated fields show crops which would do credit to any country, if rape and mustard had not been mixed with them. At the same time I can point out thousands of acres of irrigated *rubbee* which have not benefited from irrigation in any way, although the season has been such a dry one. The clay soils of the low lands, and the sandy loams of the high lands, in North Behar are homogeneous in character, and are simply influenced by the treatment they receive. The best land is the land which receives the best treatment; for instance, a field may be seen with a crop which promises 20 maunds of grain per acre, whilst alongside that very field will be found a crop of the same description that will not give 3 maunds per acre. It is hard to blame the land under these circumstances. Suppose a man to have a spirited thorough-bred horse; he starves that horse, and then rides it at full gallop in its exhausted state:—what are the consequences? The animal probably falls and kills his rider. But who is to blame under these circumstances, the horse or the man?

These dry seasons prove how organic manures [illegible] the crops, and at once point to these manures as being the best suited to this climate. I can show wheat 5 feet high; oats 5½ feet high; garden peas 7 and 8 feet high; turnips weighing three pounds each; all raised during this season on organic manures without a drop of irrigation water. And during last year, a season of scarcity and famine, Mr. Macdonald of Pertabpur factory lifted an average of 340 maunds of potatoes per acre from high sandy land manured with *seet* water; this is very encouraging, and shows that the soil is capable of great results; I should like to know if any other planter has experimented with *seet* water as a manure for potatoes.

The fact of planters wanting water for irrigation, during seasons of drought, in the hot months of March and April, when all the superior cereal crops are off the ground, does not go to show that irrigation is required for the *rubbee*. If the planters sowed their indigo in October when the *rubbee* is sown, or in June when the maize is sown, the Government would hear very little about irrigation in North Behar. Irrigation is certainly required for the paddy, but this crop is not happy unless the fields are flooded, and this condition of things is against all sound agricultural practises, as flooding and water-logging half the lands of a country for the benefit of one particular crop must injure the "dry" crops on the other half. The very fact of oats succeeding so well in these districts without irrigation should be enough to show that it is not required for the *rubbee*, as even in England oats require a damp climate. The planter in these districts who has once irrigated well manured wheat will not repeat the mistake a second time, unless he wants the crop to be ruined by mildew and rust. I may be thought guilty of exaggeration in making these statements to prove my arguments; but the field and their crops do not exaggerate, and will prove all that I say.

Now, although I am greatly opposed to irrigation for the *rubbee* crops, and hold that the *paddy chowrs* should be reclaimed and rendered fit to produce to perfection such crops as sugar cane, wheat, and barley; still I say that cultivation should be prohibited in the natural drainage channels of the country, and these *nullahs* should be deepened, embanked, and supplied with water from the big rivers so as to render them navigable. I put the question to the public: which is best suited to the country, a network of navigable *nullahs*, or a network of *cutcha* roads? The *nullahs* in this district were navigable eighty or a hundred years ago; and I do not see why they should not be rendered navigable again. The *cutcha* roads as they exist at present do the British sense of justice no credit. One of these roads presents the appearance of three roads running parallel to each other, the middle road being reserved for *ekkas* and carriages, and the two side roads devoted to the carts of the poor wretches who pay the roads cess. These roads are a great deal too wide, a great deal of valuable ground is wasted by the side cuttings, cart tracks, and big road in the middle; the side-roads and cuttings should be let out for cultivation to the ryots, on the understanding, that instead of paying rent each ryot keeps his part of the main road in thorough repair; this proposal would be greedily jumped at by the ryots. There would then be one road for all, the roads would be kept in thorough repair without costing a pice, and the rich road cess funds might be devoted to making our *nullahs* navigable. A network of navigable *nullahs* in the province will give us back the cheapest form of transport in the country; and besides helping to change the climate they will also supply the inhabitants with abundance of fish, which will swarm in the small rivers whence they can run backwards and forwards between the big Gunduck, Gogra and Ganges. There should not be locks on any one of the *nullahs*, as they would interfere with the fisheries, and raise the spring level of the country to an injurious height. The villages might be entrusted to deepen the *nullahs* at one half the amount, outside contractors would charge.

Before finishing this letter, I must touch on the great advantages which would accrue to the ryots if oil-mills were set up at every factory. Organic manure is the principal thing the land wants to enable it to produce crops sufficient to support the people, and we cannot expect to get this manure to perfection if the cattle of the country are badly fed. Do what we will by opening out the country with railways and navigable canals, but famine will always haunt the villages until the native do justice to their cattle and their lands.

D. N. R.

THE SUGAR INDUSTRY AT MACKAY, QUEENSLAND.

SIR,—It is now fourteen years since Mr. Spiller left Java and arrived at Mackay with a quantity of sugar canes for acclimatisation and if possible in due time to make sugar. The progress the sugar industry has made during the last ten years entitles it to be ranked as one of the firmly established industries of Queensland.

Mackay lies fairly within the tropics with a climate decidedly favorable to sugar-growing. Frost so dangerous an enemy to the sugar planters at Maryboro' and on the Logan, occurs very rarely

here; it has only once been known to be so severe as to harm the crop, but even then the damage done was very slight and only such cane suffered as grew in the deeper hollows of the undulatory land. The position of the greater part of the Mackay district lying on the sea coast and moreover surrounded as it is by high hills and possessing also many in its midst, all of which are more or less covered with a thick vegetation of a jungle character, ensures a regular supply of rain, the greater part of which falls during the rainy season commencing towards the end of December and continuing until the end of March. Hitherto the cane has never suffered from an absolute want of rain, although last year more rain than actually fell would have been more favorable to the crop. From the luxuriant growth of the cane as well as other plants one concludes that the soil is very rich even when taking into consideration that moisture and a high temperature tend to luxuriance of growth. The soil possesses but little lime. There are two varieties of soil here are on which cane is grown; one a very deep vegetable mould, the other a loam with stiff clay subsoil, but which, when well and deeply stirred and bedded, produces cane almost as good as the former does. The other soils vary much between these two.

Table I, gives the average temperature and rainfall as observed at Alexandra Plantation during the last eight years; this plantation is situated some seven miles inland on the Pioneer river.

TABLE 1.

	Temperature.		Rainfall.	
	M. Max.	M. Min.	No. of D.	Inches.
January	95·2	68·7	17	18·38
February	90 2	68·1	15	13 37
March	88·0	60·5	10	10·67
April	86·3	59·0	8	7·16
May	78·5	51·6	9	5·81
June	77·3	46·8	7	2·44
July	75·5	47·6	5	2·10
August	77·6	39·5	3	6·88
September	81·9	47·3	4	1·19
October	88 0	54·6	7	2·52
November	85·8	56·8	6	3·02
December	88·9	63·5	11	8·39

The first mill was erected by Mr. Davidson at Alexandra Plantation and in 1867 about twelve tons of sugar were made there. Messrs. Hewitt & Co. followed suit in 1868 and since then until the fatal disease year 1875 the number of mills increased rapidly.

In 1870 there were 4 mills with 2 stills.
,, 1871 ditto 10 ditto ,, ,,
,, 1872 ditto 14 ditto ,, ,,
,, 1873 ditto 15 ditto 3 ,,
,, 1874 ditto 17 ditto ,, ,,

The prospects of the industry were probably never brighter than in 1874, but in 1875 its progress was suddenly checked by the appearance throughout the Colony of that terrible disease in the cane, commonly known as rust. The origin and development of this disease are still not fully accounted for. Its first appearance was after an excessively heavy fall of rain. At first it was said to be a fungoid growth, later on it was found that the ravages of the fungus were augmented by myriads of *acari*, and now from the very latest information it would appear that the *acari* are probably the primary cause of the disease.

There are at present sixteen mills working at Mackay on their respective plantations (besides a few small plantations which sell their produce to the mills), as follows:—

TABLE II.

Plantation.	Owner.	Produce.
		Tons.
The River Estate	Spiller	900
Branscombe	Maitland King	400
Pleystowe	Hewitt and Romilly ...	450
Te Kowai	Sloane and Co.	1,000
The Cedars	,, (?)	250
Nebia	,, ...	300
Inverness	Geo. Raff	250
Cassada	Donaldson	180
The Alexandra	Davidson	450
The Pioneer	Spiller	800
Meadowlands and Balmoral ...	Hyne	650
Barrie	Sloane and Co. (?) ...	240
Foulden	F. T. Amhurst	550
Miclere	Carrol and Avery... ...	250
Dunbleton	Sloane and Co. (?) ...	240

Five of these mills, namely Foulden, Meadowlands, Pioneer, River and Te Kowai, boil their sugar in vacuum pans.

The average production per acre of cane crushed is as follows:—

TABLE III.

Season ending 31st March.	Tons.	Cwt.	Qrs.	Lbs.	
1872	1	10	0	22	
1873	1	6	3	19	
1874	1	8	2	5	
1875	1	17	2	14	
1876	0	14	3	2	} Effects of rust.
1877	0	18	3	14	} Effects of rust.
1878	1	10	2	6*	

Until the rust made its appearance, the Bourbon cane was the variety universally planted, since then many hardy and so far rust-proof varieties have been introduced. Those mostly met with now are, Big Yellow Meera, Black Java, Rose Bamboo, Otamatie and Gingham; in smaller quantities are also grown Caledonian Ribbon, Ireboe, Malabar and others.

The canes are not ratooned more than once, unless the first ratoons turn out exceptionally good, when occasionally they are left to ratoon a second time.

The Icery process as introduced in the Colony by Mr. DeLissa, the colonial patentee, was attempted at the Pioneer plantation, but the results did not prove sufficiently satisfactory to warrant its establishment.

At Foulden, Mr. Robert Walker, manager, a refining process has for some years been in operation, which produces one of the whitest and most perfect sugars I have ever seen turned out by a sugar mill. This process has not been introduced on any other estate, probably because it is said to be very expensive.

Sugar planters calculate upon receiving £25 per ton all round on their sugars, less *working* and *shipping* expenses.

The three mills to which stills are attached are the Alexandra, Pleystowe and Te Kowai. The "Anchor" rum produced at Pleystowe is a very superior spirit and commands the best price amongst the colonial rums.

The amount of spirit produced at the above named stills during the the season ending 31st March 1878 was 95,898 gallons which coming from 145,255 gallons of molasses gives 1½ per proof gallon; these figures compare favourably with the results obtained in the south where 2½ and 2 are the ratios. At Mackay the distillers complain that they cannot get a sufficient quantity of molasses.

Finally the prospects for next crushing season are excellent. A larger area of land is under cultivation than hitherto, and one of the planters is about to enlarge his mill in order to be able to crush cane from the many small farmers in the district. Should the cane still remain free from rust and the weather continue as favorable as hitherto, the crushing season of 1879 will prove memorable in the annals of the Mackay Sugar Industry.

HENRY LING ROTH.

Brisbane, Queensland, 29th Jan. 1879.

THE WILD OLIVE IN BURMAH.

(*To the Editor of the Madras Mail.*)

Sir,—In your issue of the 5th ultimo, I find that you publish "the discovery of the wild olive in Burmah." Several parties here have been mentioned, and each one declares that the merit of the discovery belongs to him alone, and the authorities and the public have been led to believe in a mine of wealth, that will prove more profitable than all the gold fields of Wynaad. So no wonder, that all Burmah "tuck it down like tracle," and licked their lips over it, till a letter appeared in the Rangoon *Gazette*, signed *Agricola*, in which the writer stated that this wonderful "Burmah olive" grew wild from one end of India to the other; the natives in some parts making a kind of arrack from the flower, called "Smoky Jack," while the oil from the seed gave *more smoke* than light. Throughout the Madras Presidency, it is known in Tamil, as "Illapay"; and by the Teloogoos, as "Ippay," while from Orissa, in Ganjam, and through all Bengal, it is also known. Look at any Price Current or Customs Statistics, and I am sure you will not be able to find the seed or the oil of this famed olive quoted, as an article of export; and if this is so with regard to India, where the tree grows wild, and where labour, is so cheap, how is it possible that any one in Burmah investing in such an undertaking can ever expect to realise a single fraction of their outlay, when an ordinary cooly turns up his nose at an offer of Rs. 10 a month, and where the Burman will not work for you! But supposing for an instant that the tree will answer all the expectations formed of it, what then? Will Burmah stand the least chance with India in the markets? Certainly not; the planters in Wynaad would be able to plant the whole of that district with it, and export it at a quarter of the cost, which one would incur in Burmah

During all my stay in Wynaad, I never saw the people make any use of either flower or seed. Hoping none of your readers will be gulled as the Anglo-Burmese appear to have been.

OBSERVER.

The Indian Agriculturist.

CALCUTTA, APRIL 1, 1879.

THE BAMIEH COTTON PLANT.

THE endeavours that were made during the last two years, to introduce the Bamieh cotton plant into India, have on the whole been fairly successful, inasmuch as it was shown that the climate and soil of different parts of India are suitable for its cultivation; but a great doubt exists in our mind as to whether the *bulk* of the seed received in India was really Bamieh cotton, as there is a great deal of evidence forthcoming which shows that the majority of plants raised from the seed possessed none of the peculiarities that distinguish the Bamieh cotton plant from the ordinary Egyptian cotton.

This new and important species of cotton was discovered by a Copt in the Nile Delta neart he Cairo Railway, in the province of Menúfié, in 1873. The Copt noticed a plant in a cotton field, wholly different from the rest, and carefully collected the pods, separated the seed and planted it secretly in an isolated plot of ground. He carried on the cultivation of this new cotton for three years, before general attention was drawn to it. For the last two years the area in Egypt under Bamieh cotton, has largely increased and its cultivation is sedulously promoted by the Minister of Agriculture; it has been calculated that there will be sufficient seed available this year, to cover with Bamieh cotton the whole area that is fit for cotton cultivation in Egypt, amounting to about 700,000 jeddans (350,000 acres). The importance that attaches itself to the cultivation of this new species, consists in its yielding per same area, nearly three times as much cotton as the ordinary cotton plant. The Bamieh cotton plant has straight stems, attaining a height of nine to ten feet, and instead of throwing out lateral branches, produces two or three semi-verticillated pods, issuing directly from the axilla of each leaf, these being alternately arranged around the stem.

The ordinary Egyptian cotton plant, on the other hand, (in its varieties; *Mako-Jumel Gallini, Ashmúni, etc.*), has the form of a shrub, with one or more main stems throwing out numerous lateral branches, which occasionally spread out to a considerable breadth and bear pods at various intervals, two, three or even four leaves often producing no pods from their axilla. The leaves of the Bamieh cotton plant are large, greatly undulated, and of a deeper green than those of the ordinary cotton. Its flowers are yellow, the interior spotted with purple somewhat like those of ordinary cotton, but they are frequently larger-sized, and grow on elongated peduncles.

As to its origin, it is thought that the contact of Bamieh plants, which existed in the cotton plantation of Birket-el-sab, having produced this new type, acted upon the seed of the cotton plants at flowering time, and that the origin of this species may therefore be attributed to a process of hybridisation between the Bamieh (*Hibiscus esculentus*) and the ordinary cotton (*Gossypium barbadense*), the more so as, when seen from a distance, plantations of this new cotton display, like those of the Bamieh, (*Hibiscus esculentus*) a multitude of high, straight stems without branches, at least as regards three-fourths of their length from the tops. If it be true that the new Egyptian cotton is the result of hybridisation between the two species above named, the fact is one of great importance to science, because in the annals of horticulture, the process between species differing so widely is rare enough, and because such results as have been recorded down to the present time have generally remained sterile, or at best but of little use in the sequel; whereas in this case Nature has produced a more fertile cotton than the ordinary kind.

The "Bamieh," we may mention, is the plant known to us in India as the *Bhendi* and *Rainturai.*

Seed of the Bamieh cotton plant was obtained in 1877, by the Government of India, by the Agri-Horticultural Society of India, by Messrs. W. Nicol & Co. and several others. The seed imported by Messrs. W. Nicol & Co. was sent to their mofussil branches in Guzerat, and in November 1877 we heard that there was about an acre of land under cultivation with this cotton, one half of the land being irrigated and the other left to the action of the ordinary rains. The results of this experiment are not known to us though we have made some enquiries regarding it. The Agri-Horticultural Society grew from the seed it received a few plants in their own garden at Alipore, and distributed the rest to the Governments of Bengal, the N.-W. Provinces and private individuals.

In the Society's Garden at Alipore, the seed that was sown in the middle of June 1877, grew vigorously to ten feet in height, began to blossom in September and the plants yielded their first ripe pods in October and November. In April of the following year (1878) it recommenced to flower, and it was proposed to allow the plants to remain as biennials, in order to ascertain if the quality of the next season's produce would retain its character or deteriorate.

From the seed sent to the N.-W. Provinces, a small quantity was sown at the Experimental Farm at Cawnpore, on the ridge system. Of 20 seeds sown, 13 germinated. They were sown in July; first bolls were picked on 20th December; yield of the 13 plants five pounds Kapas (uncleaned cotton), of which four and a half pound on being passed through the native *churka*, yielded 22 ounces of clean cotton and 3 lbs. 2 oz. of seed. The plants were grown 2½ feet apart, and threw out long lateral branches, a few of the plants only being of tall upright growth with few side branches. Mr. Buck observed the distinction between these few plants and the rest, and has gathered the cotton and seed separately and has called that, obtained from what appeared to him the true Bamieh cotton plant, No. 1, and what appeared to him the ordinary Egyptian cotton, No. 2.

Mr. W. Masters, of the Opium Department, at Hadjepore, also grew a few plants and reports the plants as having a main stem, ten feet high, with lateral branches, issuing from it within the space of a foot and a half from the ground.

Messrs. Haworth and Co., of Calcutta, report on this cotton, grown as above, as follows:—

1 Bolls similar to Egyptian cultivation, and like it as regards its seed, both as to formation and freedom with which the fibre can be separated. (*Cawnpore Model Farm*)

2. Not of a particularly good color, but as regards length, softness, strength and fineness of staple, every thing that "could be desired, and would rank as good fair, Egyptian cotton, valued at about 7 to 7½ per pound." (*Ditto*).

3. Not equal to No. 1, either in size of the boll or the quality of the cotton, but similar in all other respects. (*Mr. Masters*).

4. Equal in color to No. 2, but containing considerably more stains, harsher in staple, which is also wanting in length and strength: value about 6 to 6½ per pound. (*A. H. Society's Garden.*)

The agent of the Elgin Cotton Mills at Cawnpore thinks the staple of the Cawnpore-grown cotton particularly fine

and equal to cotton used in England for the spinning of yarn of counts ranging between hundreds and two hundreds, and estimates its probable value in England at a shilling a pound. The same cotton was reported on by Mr. C. Kapp, one of the most competent judges in Bombay, at the request of the Secretary to the Chamber of Commerce, as follows :—

"I have received your note and a sample of cotton. After examining the latter carefully, I have come to the conclusion that the nearest comparison in appearance and touch to it is fully good fair brown Egyptian cotton. The staple is silky, but very irregular and very wasty, which deficiency would debar this style of cotton from being mixed together with Egyptian, or used separately for high numbers. Besides the irregularity in the staple, there are very objectionable knots and nests in it, which reduce the value of the cotton. Taking into consideration that the price of Egyptian cotton is exceptionally high now, and fully good fair brown being quoted about 9½*d*. I value the sample at ½*d*. below that class of cotton, say 9¼*d*. If the cotton has not been allowed to mature fully, this circumstance might account to some extent for the wasty staple, but even admitting that some of it has been picked in an unripe condition, the best of it would not be worth more than 9¼*d*. which would be equal to good brown Egyptian."

The details of the experimental cultivation of this new species at the Bhadgaon Government Farm, Kandeish, marred greatly by the adverse season, were published in our last issue. Mr. Stormont states that he finds little difference between it and the ordinary Egyptian cotton. The resulting fibre was submitted by Government to the Bengal Chamber of Commerce who report :—

"The staple is long and strong; the cotton is clean and very free from stain, and the colour and general characteristics are those which belong to cotton grown in Egypt.

The Committee of the Chamber are of opinion that if the quality were kept up to the sample before them, and spinners could depend on a certain regular supply, this description would in process of time come to compete side by side with Egyptian and the better qualities of Brazils in the home markets.

It is very superior to any Surats yet exported, and till it becomes known and appreciated, it is difficult to fix the value. The Committee think, however, they may roughly quote it to-day at Rs. 20 to 21 per maund, or to sell in Liverpool 5¼ to 5½ per lb."

If we read, in conjunction with the above, the report on the Bamieh cotton plant furnished to the Egyptian Ministry of Agriculture by Monsieur Delchevalerie, we can but come to the conclusion that the seed received in India in 1877, was not pure Bamieh cotton seed, but was adulterated and, if not entirely consisting of the ordinary Egyptian cotton, was so largely mixed with it, that on this account the experiments cannot be pronounced as decisive; and we can only hope that the further supply of seed (12 pounds) which the A. and H. Society received last June from Mr. Chapman, the agent of the P. and O. Co., at Alexandria, will turn out better.

The following details of an experimental cultivation of this cotton, which was made in Texas in 1877, is taken from our contemporary *Cotton*, and will be found interesting :—

"The seeds were planted on 4th May, in a garden situated in lat. 29° 40′ at an elevation of thirty feet above Galveston Bay, and about 800 yards from its margin. The soil was a light, fertile, sandy loam. The seeds germinated, and the plants made their appearance above the surface of the soil in six days, namely, on 10th May. The first blossoms appeared on 8th July, and the first open fruits on 30th August. The average height of the plants was about eight feet, but some grew up to ten feet. After the plants had ceased growing the fruits perfected themselves, increasing in size. It is stated that the fruits are very abundantly produced from near the base of the plant to its very top. In the space of four months and ten days from the time of planting, the open fruits were of sufficient size for picking in any quantity. From as careful and safe an estimate as could be made, the yield was found to be fully equal to 2,500 lbs. of cotton in the seed per acre. The habit of the plant is described as being very singular in its outline. Unlike the American Upland, and Sea Island cottons it does not send off branches regularly from near the ground to the top of the plant; but the main stem bears close to the ground two, three, or more branches, and then rises to a height of eight or ten feet without a branch. Leaves only are given off along the stems, and in the axil of each leaf are from two to five, and sometimes six long petioles each bearing a fruit. The branches described at the base were also very heavily fruited, as many as five large fruits growing so close together as to touch each other. The cotton or wool contained in every fruit on the plantation was of a pale yellow color, which was difficult to be accounted for, as there had been no heavy rains during its growth to stain it; it it is suggested the profuse dews may have been the cause. From the record of these experiments it seems that we may still hear something favorable, about Bamieh cotton with regard to its becoming an article of commerce."

CULTIVATION AND MANUFACTURE OF TEA.*

UNDER the above title, Colonel Money has published the third edition of his Essay on Tea, which received the Grant gold medal and a prize of Rs. 300 from the Agri-Horticultural Society of India in 1872. Circumstances have considerably altered since then; our knowledge of tea has been considerably enlarged and added to, during the six years that have elapsed. Managers of tea estates are drawn now from a more intelligent class of men, and altogether, with the exception, and it is a very great one, of manuring, there is little in the practice of cultivating and manufacturing tea, as practised in most of the well managed estates of Upper and Eastern India, that is open to any great improvement. Colonel Money has advanced with the times, and the work under review may well be considered a standard work on the Cultivation and Manufacture of Tea, which ought to be in every tea planter's library in India, Ceylon, Java, Japan, China or America. The merit and sterling value of his first essay has been so universally and deservedly acknowledged, that all that is left for us to say is, that this, the third edition, contains all the additional information that has been gained during the last six years, has been corrected up to date, and much enlarged. The value of Colonel Money's work is enhanced by the fact, that he has seen and studied tea cultivation in most of the districts of which he treats, and that he deals with the whole subject in a practical manner, and has very few scientific theories to advance. Our space does not permit us to do more than briefly notice the principal points and features of Colonel Money's book.

Colonel Money defines in the first seven chapters the conditions requisite for success in tea cultivation. He is of opinion, and experience supports him, that on a suitable site, and in a good tea climate, tea will pay; it is equally certain that it will be unsuccessful in a bad locality and on unsuitable sites. No garden should exceed 500 acres under tea, and if highly cultivated, Colonel Money says, even half that size will pay better than a larger area with low cultivation. This is, of course, excluding such land as should be reserved as forest lands. In fixing on any district to plant tea in, four things have to be considered, *viz*, climate, means of transport, labour and soil. The climate required for tea is a hot damp one, the rain-fall should not be less than 80 to 100 inches per annum and should be well spread over the year. The plant will certainly grow at a great elevation, and even at freezing-point. But the flushes of leaf there are less frequent, and the manufactured article has less strength. Tea flourishes to far greater advantage where there is hot sunshine, copious rain, especially in the early part of the year, and rich soil. Drought shrivels up the leaf; cold stops its growth. The drier climate of the North-Western Provinces is far inferior to the moisture and heat of Assam. Colonel Money, in Chapter III, puts the tea-growing districts or provinces of India through a sort of competitive examination, in which the subjects selected are climate, labour, lie of land, soil,

* *The Cultivation and Manufacture of Tea*, by Lieut.-Colonel Edward Money. Third edition, corrected and much enlarged. Calcutta: Thacker & Co.

and transport; and then adjudges the prizes to Assam, Cachar, Chittagong and the Western or Bhootan Doars. Kangra, Kumaon, the Dhoon, and the Neilgherries, though charming for invalids enervated by long residence in the plains, are prejudicial to the tea plant as far as quantity of outturn is concerned; for the Kangra valley teas as regards quality excel in delicacy of flavour any other Indian teas. Assam and the Terai are first and second in this part of the schedule.

We have already referred to the size of a garden, as recommended by Colonel Money. A very large acreage means heavy expenditure with disproportionate yield. An estate of 3 to 500 acres, in full bearing, where there are no "vacancies," with a good site, cheap labour, facilities for manure and ready transport, will yield a more certain and a larger return than a vast area badly chosen and not highly cultivated.

Tea luxuriates in friable soils, with a sandy or loamy subsoil; light coloured loamy soils or sandy loams, containing 5 to 10 per cent. of organic matter in the upper layer being preferable. Stiff soils of every kind ought to be avoided and no matter how light and friable the surface soil, if the subsoil is clay, the site is not suited for tea cultivation. Forest and grass lands are equally suitable. The "lay of land," is a subject on which Colonel Money speaks very lucidly. In the Himalayas for instance the warmer aspects are, as a rule, the most fertile: *vice versa* in warm climates. There are few if any planters now, we think, who would dream of laying out a garden on *steep* slopes, experience having shown that even where terracing was tried, the surface soil was gradually washed away into the valley below. Gently sloping valleys or table lands, are the choicest sites for a tea plantation. In Chapter VIII, the advantages of dividing gardens into sections of 5 acres each are set forth, the chief of them being that each section can be treated, regarding plucking, as an independent portion from the rest. Only where the soil all over the garden is the same, and observation shows that it flushes equally, it may be left all in one. In the Chapter on "Tea Seed," sufficient stress is not, we think, laid upon the advisability of gathering seed *only* from tea plants that have been allowed, for a couple of years at least, to grow naturally without plucking or pruning. We hold that seed collected from plants that are regularly plucked, is degenerated and ought never to be used for seedlings.

Regarding sowing in nurseries or *in situ*, Colonel Money says that where planting *in situ* will succeed, it is by far the cheapest and best, but it will only succeed, where there are cold weather and spring rains, and even in those climates success is not certain, as the early rains often fail, so that in all cases nurseries in reserve are advisable. Chapter XII and XIII give detailed and clear instructions how to raise plants *in situ*, and in nurseries.

Regarding manuring Colonel Money says:—

"My first experience of manure to the tea plant was obtained in the Chittagong district from a small garden close to the station, which has been for some years highly manured. I was struck with the frequency and abundance of the flushes and the strength and flavour of the tea. My high opinion of the tea was later borne out by the Calcutta brokers. I allude to the 'Pioneer' garden, close to the Chittagong station. During the best tea months, flush succeeded flush at intervals of less than a week, while 8 to 10 maunds (640 to 800 lbs.) was the yearly yield per acre! The soil was very sandy and poor.

After-experience showed me that manuring nearly doubles the yield of plants, and that so far from injuring the flavour of tea it improves it while it adds greatly to the strength.

I shall therefore beg the question that manure is an advantage. If any planter doubts let him try it, and his doubts, will soon be solved."

We take exception to Colonel Money's advice to bury garden refuse and prunings in a *green* state between the plants. This is an objectionable practice, being certain to encourage the propagation and development of the fungoid and animal parasites, comprised under tea blights. The researches made in Ceylon, have given full and clear evidence of this. The garden refuse and pruning, we advise on the contrary, should be collected in large manure heaps, their decomposition should be hastened by an admixture of caustic lime, and they should be covered with a layer of soil, to be kept moist, so as to absorb the ammoniacal gases of decomposition.

In planting out a garden, 4 to 4½ feet is considered by Colonel Money the best distance between the lines, the object being to place as many plants on the land as it will bear, and leaving yet sufficient space for cultivation between the lines. Chapters XVI and XVII are taken up with advice, how to make a garden and how to transplant the seedlings; attention is drawn there to Mr. Jeben's transplanting and transporting tool, regarding which an independent planter writes: "No manager of a tea or coffee plantation, who had once seen this instrument at work, would ever again be likely to recur to transplanting by hand." Colonel Money considers this invention, a most important one. Space does not permit us to follow Colonel Money through the remaining chapters treating on the cultivation, pruning and plucking of *made* gardens, and their treatment generally, as well as on the manufacture, sifting, sorting and packing of the tea, on all of which subjects he speaks with great experience and advances valuable suggestions for improvements. Nor can we follow him through the chapters on the management of tea gardens generally, on the cost of manufacture, cost of making a garden, the profit tea can give and his concluding chapter on the "Past, Present and Future of Indian Tea," subjects which are treated by him in an equally lucid and authoritative manner, but we recommend our readers who desire full information and sound advice on the above, to peruse Colonel Money's book, which must undoubtedly be considered a standard work on "The Cultivation and Manufacture of Tea."

INDIAN RIVERS.

INDIA presents many fierce contrasts to England; but perhaps in nothing more strongly than in her rivers. The name of an English river calls forth all pleasant summer thoughts, and sweet images of shade and soft turf, and green leaves, and glancing water. The Indian river, at its best, has no such associations. Hill streams are sometimes pretty and picturesque, though rolling through rocky wildernesses to which the grace of moss and heather has been denied; and though the most that can be said of them is that they serve to remind the traveller of more lovely and familiar scenes left behind. But what shall a man say of the rivers of the plains? The theme is not one in itself devoid of beauty and charm. A great English poet, imagining pictures for his soul's delight, chose to adorn his fabled Palace of Art with the likeness of—

> A full-fed river, winding slow,
> Through herds upon an endless plain;

ever as Homer wrought the same picture by Vulcan's hand upon the shield of Achilles, to signify the happy pastoral life, with its wealth and quietness and peace. Alas, the Indian river, albeit winding through an endless plain, is no more full-fed than the herds upon its banks. It takes one of two shapes. The less common is that of a tortuous muddy ditch, brimful, indeed, in the rainy season, and for some short time after not wanting in a fair supply of water, tolerably clear; but soon shrinking, summer-dried, when men's need is the sorest, into a stagnant canal, foul, choked with weeds, and deep sunk below the level of the parching fields. Or, if the water be stopped by a dam, and made to give life and brightness for some few miles above, nothing can be more forlorn than the wanderings of the dry channel below, as it twists aimlessly through the land, filling the air with the sick smell of aquatic plants perishing under the pestilent sun. The other type of river is one which fails not for water, but its surroundings are the abomination of desolation. Little need is there to recall the picture, familiar to every sojourner in this country, of the inhospitable wastes

which spread around the course of the historic streams of India and all their major affluents. The river makes known its presence from afar, by the bright gleam reflected from many a mile of hot dazzling sand, through which man and beast plod heavily on to the margin of a deep, rapid, turbid stream, some few score yards broad, flowing close under a high bank of clay, into which it is for ever eating, and the plash of falling fragments is the only sound heard along its melancholy banks. No trace is here of the "glassy, cool, translucent wave," nor any of those pleasant things which have in all ages drawn Western poets to the riverside for inspiration. The myths of the East assign a hideous origin to the Father of Indian waters. He comes tumbling from the interminable unkempt locks of Siva, the Destroyer, bringing with him all his train of alligators, crocodiles, turtles, water snakes, and whatever other noisome and loathsome creature rejoices in his sacred stream. The gaping mouth and serrated back of a huge lizard, or the round shell of a great tortoise, fed on corpses, or perhaps the corpse itself, drifting hopelessly down the mid-channel or stranded on a shallow, and covered with gorging vultures—these are the sights which enliven the Ganges strand by day, and at night, near large cities, the course of the river may be tracked by the glare of funeral fires. Nothing more depressing can be imagined than an evening ride over the river sands in the sultry time of the year. In the rains, all this is a waste of waters, too dull and turbid to lend any charm to the landscape, while swift currents and sudden blasts make it useless, and indeed dangerous, for the boating which its wide expanse seems to invite.

If the objectionable points of Indian rivers, however, were of a merely sentimental character, one might be content to leave them alone. But there are other bad qualities which give a deal of trouble of a much more practical nature. The river, in the pride of its floods, has a tendency to sweep the works of man off the face of the earth. Every one knows the story of the difficulties attending the construction of all our large Indian bridges. Without mentioning such giants as the Sutlej or the Ganges, one may quote a piece of experience from the Ramgunga, a river of the second class, which was forced to submit to a bridge some six years ago. It did not yield without a struggle. The piers had been sunk to a depth of seventy feet, and then the floods came, and when they sank, the massive pillars were found lying under hundreds of tons of sand, in the river bed, carried by some unaccountable current several yards up the stream. The railway now travels over piers which rise thirty feet above the water, and reach down a hundred feet below it. If these things happen to vast viaducts, one can easily guess the fate of villages which stand in the way of the stream. The loss of personal property, indeed, is not much; for the village rose out of the soil and sinks unregretted into it again, while there has usually been ample warning for the removal of the few brass dishes which are the Indian peasant's household goods. But the loss of the village lands is a more serious matter. So long as the process of destruction is gradual, the hardship is less felt. The cultivator has time to look about for land elsewhere, and he will not throw away his seed upon a field which seems likely to fall into the river as soon as the rains begin. But a few years of gradual erosion are often succeeded by a sudden change, transforming all the riverine topography, and throwing hundreds of acres out of cultivation in a single night. It is not merely that the river has struck out a new course, leaving the old bed dry, and the surrounding country as it was before, except that a certain number of fields have been appropriated for the new channel. That would be a small matter, of which nobody need complain. But the truth is that the river, as it advances in its process of erosion, leaves behind it only stretches of barren sand; and when a sudden change comes, the utmost gain to the adjacent villages is that this unfruitful tract is secured to them, safe from fluvial action for a term of years, in the place of the good land which was swallowed up, digested, and then voided forth again deprived of all its nutritious properties. At present the river is eating somewhere else, perhaps in quite the contrary direction, and may reasonably be expected not to return here for many a day. Meanwhile the low and level sands are put to such uses as they will bear. Their first fruit is a spontaneous growth of tamarisk; a kindly shrub which clothes the bare waste with grace, and gladdens the traveller's eye with green, and his memory with the songs of a happier clime. It was in a tamarisk thicket that Ulysses captured Dolon, by Scamander bank; and the "humble tamarisk" gave the shade under which the Sicilian muses, and those not less sweet of later Italy, tuned the pastoral reed to sing the indolent charm of summer days, dreamed through in company with beauty and love. Not of these things does the Indian herdboy dream, as he drives his ungainly buffaloes through the clustering bushes of their new pasture-ground. The land is used in common by all the villages among which it lies; and, for a time, no one is careful to claim possession of any part of that which is of so small value. But the tamarisk roots bind the shifting soil; the droppings of their branches slowly fertilize the ground; the very cattle tread it into consistency, and enrich it after their fashion. Gradually the agricultural capabilities of the soil are restored; the useful jungle, having done its work, disappears in firewood, and ploughed fields begin to take its place. Patches of the richest soil are discovered here and there. The river has not wholly destroyed what it devoured, but has sometimes cast it forth little changed, covered perhaps with a thin layer of sand, but charged with the water which it wanted before. Luxuriant under-growth of clover attests the productiveness of the damp soil beneath; and when it comes under the hand of the husbandman, thick vetches and peas, and tall lush wheat, prove that the new acquisition is one which, save only floods, will yield the wealthiest crops in places now, and may be trusted to do so almost everywhere hereafter.

From this moment, the neighbourly joint occupation of the alluvial tract is at an end. Each of the surrounding villages asserts its undoubted claim to the whole. Perhaps a nominal settlement has already been made with some of them, while the land was yet valueless, and when nobody was minded to dispute a claim which did not immediately affect the rights of others. Now, however, that the value of the land has become evident, the nominal owner meets with all kinds of difficulties in enforcing his title. Whole fields lose their crops mysteriously in the night, the tenants are made to understand that they had better not try to enter into possession of the fields leased to them; and the land is openly encroached upon in all directions. It is in vain that orders, upholding the settlement are fulminated from the highest authority. Local influences are too powerful, local temptations are too strong. At last, after seven or eight years of continual lawsuits and criminal prosecutions, where victory inclines with glorious uncertainty to either side, the state of things is recognised as intolerable, and an English officer is sent out to put an end to it. This is indeed a great day for all persons concerned. For once, their conflicting aims are all the same,—to bamboozle the stranger who has come out to be an arbiter over them; only, of course, each wishes to mislead him in a different direction. Herein lies his safety, for the amazing discrepancy between their several stories soon suggests a wholesome doubt as to the truth of them all. If one were inclined to be serious, it would be difficult to imagine any more shocking moral spectacle than the utter disregard for truth displayed on all sides. The enquiry is one where a plain and fair statement is sorely needed. It is hopeless to try to unravel the tangled handiwork of the river, by inspection of the village maps drawn before the river took to transgressing it wonted bounds. Parts of the village lands, left undestroyed upon the high ground, can indeed be traced, but the moment one descends into the alluvial basin, all is delusion, nought is truth. Each claimant declares the lands of his own village to have occupied, if not the whole basin, at least the greater part it; and no piecing together of maps will enable the bewildered revenue officer to say with tolerable certainty where the old bounds of any one village really were. Only a professional surveyor, with the aid of the survey maps (which are other than the comparatively rude village maps maintained for revenue purposes), can restore the ancient limits, and give every one his due. The ultimate decision must of course be made by the revenue authorities. But one does not see why our magnificent survey maps should be left unutilised; nor why an annual survey should not be made of all alluvial villages, so as to keep up that which is most of all

wanted, and which would save immense vexation and trouble in the future—a timely record of all the changes wrought by the river.

JOTTINGS FROM MADRAS.

IT may not be uninteresting to your readers to hear how successfully the Famine Commission avoided the risk of being obliged to consider such facts regarding the agricultural condition of the Madras Presidency, as would have been given them, had the agricultural adviser of Government, Mr. Robertson's evidence been taken. Not only was his evidence not taken, but endeavours were apparently made to suppress, or not to bring to notice an elaborate series of answers to Mr. Elliot's questions, the issue of which preceded the formation of the Commission. The F. C. contented themselves with a morning's walk at the Sydapet Experimental Station, and with a cursory inspection of the temporary arrangements for conducting agricultural education there. Such a visit whilst it might seem to casual observers to indicate a wish to investigate the agricultural problem thoroughly, was in reality a mere blind, astutely devised by the Civilian guides of the Commission to prevent their unbiassed colleagues from hearing what independent observers consider to have been the results of the system of administering this country, for which the covenanted Civilians are primarily responsible. The Government of India were wise, in appointing Mr. Elliot to the position he occupies as personal conductor to the farce, which is now being committed. Not the slightest endeavour was really made to obtain the opinions, or to learn the views of the educated agriculturists in the service of the local Government. These facts would seem to indicate that the Supreme Government look with disfavour on endeavours to introduce a system of Rational Agriculture into this country; and that their Etcetera Department is only maintained for the collection of very incorrect statistics, which may be useful, but the object of which it is at present difficult to determine, and perhaps to furnish a number of comfortable berths for their protegees. If, instead of the present very unsatisfactory state of things which exists in Madras as elsewhere, the local Government would make full use of the establishment of agricultural officers, whom they entertain, much good work might be done. Not but that a great deal has already been performed, but all agricultural matters being under the direction of the Revenue Board, it is impossible to expect from that cumbrous and stop-the-way institution that any real endeavours will be made to give the country what it most requires. A similar arrangement, with regard to the Forest Department, was tried and found to fail most miserably. As was suggested by a writer in a recent pamphlet, the agricultural officers of Government should be taken from under the wet-blanket influence of their present superiors, and put in direct communication with the Government. It might then be easy for them to bring matters before Government without loss of time.

It was suggested in a local paper sometime ago, that Government should divide the Presidency into Commissionerships; if this were done, every Commissioner ought to have an agricultural adviser, who might also supervise the work of agricultural education in the local schools, on a system something similar to that prepared by Sir R. Temple in Bombay. Besides these local advisers, the Government ought to have on their staff some educated agriculturist to direct the operations they decide on, and to advise, on topics relating to his profession. Such an officer would find more than sufficient work in carrying out his duty. To him also should be committed the supervision in particular, of the higher educational work, such as that conducted in the agricultural college at Sydapet, and the general supervision, similarly to the Conservator of Forests in his own department, of all the agricultural officers of Government. It was suggested, I believe, to make 5 Commissionerships; if so on the plan which I now suggest, it would require the services of 7 officers to carry on such a work, besides trained native subordinates; thus—

Agricultural Adviser to Government, and Director of Agricultural Education	1
Professor of Agriculture in Central College	1
Agricultural Advisers to Commissioners	5
Total ..	

Such a system might be applied to every province of India, and would, I think, form an efficient ground work for starting substatial agricultural improvements. Of course it would be costly, and at present, in the face of late famines, and present war, might not be adaptable *in toto*; but nevertheless, with £1,500,000 to be spent per annum in measures calculated to lessen the effects of deficient rainfall, it should be possible for the Imperial Government to do something towards what most thinking men in India are beginning to look upon as the best means of averting future disaster.

What the intentions of the local Government may be I am unaware; but I believe that under pressure from Calcutta, in order to prevent Lord Cranbrook's surplus dwindling into a deficit, it is likely that considerable reductions in the public service will be made. If this be so, it is to be feared that in their present state of callous indifference to the real wants of the country, the Madras Government may show itself to be as benighted as its brethren in the other presidencies. It is however a good sign to see, that the native community is itself beginning to demand that their English rulers should not keep back from them the discoveries, which science has made, and which are so valuable to the cultivators, be he Hindu, or English, Parsee or German. Their demands are far more likely to be heeded than the warnings of any number of educated farmers.

MADRAS, 14th February 1879. AGRICOLA.

VILLAGE STATISTICS.

A NEW statistical register has been opened by orders of the Director of Agriculture and Commerce in the North-Western Provinces. It is an English list of villages, to be kept partly by native agency and partly by Assistant Collectors for the portions of districts under their charge. The object is laudable, and we sincerely hope it may be found capable of realisation. But we cannot forget that schemes, instituted on the first creation of the Director's office, four years ago, still remain in great part unaccomplished. The remodelling of village returns, in the vernacular, though long ago perfected on paper, has not yet properly begun to take a practical shape. There can be no question of the wisdom of the scheme; and it is, therefore, all the more provoking to find it frustrated by obstacles of a purely mechanical character, which demand only a little methodical energy for their removal. In some districts, matters are at a standstill for want of the new printed forms, which are not supplied till months after they are due. This is obviously a difficulty which ought never to have arisen. It is a gratuitous complication of an enterprise which has already to contend with a variety of embarrassments, due to the stupidity or untrustworthiness of the village accountants whose papers form the basis of the whole system. In this department, as in many others, the great desideratum is trained officials in the lower grades; and a special element of difficulty exists in the fact that the Government is not free to select these men with a single eye to their acquired qualifications. The wishes of the landowners must be consulted, and hereditary claims have to be taken into consideration. It is hopeless to expect good work from a village accountant who is on bad terms with the landlord; and if local rights be set aside, the family of the man passed over are pretty sure to make the village too hot for his rival. There are provisions requiring the examination of all new men, but they too often remain a dead letter. Organisation is wanted, and can be attained only by degrees. Meanwhile there is always a certain proportion of village accountants who are incompetent by reason of laziness or ignorance, or a fraudulent turn of mind. Their papers are constantly overdue, and when they do come in, they are found to be incorrect. Yet it is often found that the lesser of two evils is to retain these men in office, under a regular system of fining, rather than get rid of them on the chance of being able to supply their place with better. In fact, it is only on rare occasions that the quality of their work is brought under the notice of the Collector. One of the chief merits of the new statistical register will be an increase in the number of these occasions, and a more regular supervision on the part of the English officer. The register is to come into use next year; but one would be over hopeful to expect that it will be in full working order for two or three years to come.

Its principal claim to notice, however, is a matter of detail, unconnected with the general scope of the system it is intended to serve. We mean the little proviso that the figures, in the portion to be filled in by native agency, shall be recorded in Roman characters. We should be glad to welcome this simple rule as the herald of a great change. But if we look only to the immediate purpose of the register, we shall find reason enough to applaud the wisdom of so bold a divergence, albeit in a small matter, from the time-honoured practice of Indian scribes. In nothing is the perversity of Eastern notions more strikingly illustrated than in the fashion of recording numbers, not by plain figures, but by a kind of short-hand which takes up more room, is longer in writing, and is usually more or less capable of an interpretation to suit the reader's pleasure. The sole merit of this kind of notation is the symmetrical beauty of its appearance. A tabular statement filled up thus is a really pretty specimen of penmanship; but all regard for its neatness vanishes when the native clerk begins to read it aloud. The leading numbers are managed with comparative fluency, though mistakes occasionally occur even in these; but fractions of a rupee are invariably the subject of large guess-work and copious error. It is hardly necessary to remark that fractions are recorded in a fashion which, among Western nations, is peculiar to mariners alone. They heave the lead and read their soundings on exactly the same plan as the native accountant who records his small change in fractions of a rupee, not in units of annas and pies. The plan is a scientific one, and the record of it, as noted above, is calligraphic in a high degree; but for practical purposes the whole system is inconvenient and uncertain; and it has survived to this day only because all things old are treated with a semi-oriental reverence—wise enough, if not exaggerated—by the English rulers of India. We may perhaps hope that reform, once started, will take a wider range, and that not this single register only, but vernacular returns generally, will gradually come to be recorded in familiar figures. The change is one which might be made at once in all tabular statements compiled in the sub-divisional offices of districts, thus relieving the Central English offices, already overworked, of all the labour of translation. We cannot yet demand that the village accountants should keep their books on the same principle; but a beginning might be made by encouraging them to expect better chances of promotion if they qualify themselves to use English headings and figures to returns with which they have long been perfectly familiar. For the rest, there would be no such necessity of change. The names of the tenants, if written with tolerable care, are always fairly legible; and the adoption of the plan proposed—a perfectly feasible one, if worked with discretion—would render the village records intelligible to every Assistant Collector, without the need of any interpreting medium. It is superfluous to point out the great stride thus made in the direction of an effectual system of supervision. Familiarity with village records would be a simple matter, if the sub-divisional officer were able to carry them home and inspect them for himself, over his camp fire. This will never be done while the present vernacular method is in practice. No English officer has time to make himself thoroughly conversant with native handwriting, and it certainly is not desirable that he should create leisure for the purpose, by neglecting other duties for the sake of a mere mechanic art.

So much for the immediate effect of the new register, with its characteristic Roman notation. It is impossible, however, to resist the temptation to look beyond the domain of figures, and to speculate on the possibility of a widely extended use of English as the medium of official correspondence. The disadvantages of the existing system are so obvious as scarcely to need enumeration; but it may be worth while to remind the reader that nine-tenths of official correspondence in India is carried on in writing which the corresponding officers are unable to read; that the state of vernacular files depends mainly upon the interest or inclination of some native subordinate; that petitions are not perused but only listened to; and that mistakes are perpetually occurring because the listener's attention is otherwise engaged, or because the reader blunders in his monotonous occupation. One-half of the toil accompanying the charge of a district—and those who have tried it know what it means—is due to the single circumstance that the Collector is not free to take up files for himself, examine them, and write his orders with his own hand. No doubt, such a change would be a great one, and not to be made in a year, nor in several years, but surely it is high time to prepare the way for it. Nobody can suppose that the vernacular languages, with their manifold imperfections of vocabulary, structure, and utterance, will permanently continue as the medium of official or intellectual intercourse. But it is a mere want of foresight to neglect the preparation for a change which will certainly become inevitable. Already we have examples of a successful beginning in some isolated departments. No vernacular correspondence is permitted in the local Secretariats. It is not so long since the High Court of Allahabad decreed that all pleadings before it should be in English. Objections were not wanting at the time; but the result has been a vast gain to the public, both as regards appreciation of the points of their cases, and also in the expedition of business. The same high tribunal wisely determined that the Recorders of the Judge's Courts should in all districts be men conversant with English. The innovation was strenuously opposed; but it has amply justified itself by its results, proving that it rests only with the Government to create a demand, and the supply of English-speaking native officials will be forthcoming at once. Let the Government then extend its demand a little further. We do not advocate sudden or sweeping changes. A good beginning might be made with a rule requiring the head vernacular clerks of Commissioners' offices to know English, and providing that, after a certain date, these offices will decline to receive any papers in the vernacular. The next step would be a similar rule regarding native sub-divisional officers, as well as the central sub-divisional supervisors of village accountants. This much having been effected, the rest would follow of itself, while the immediate result would be an immense simplification of administrative work. Then the Collector could really judge the work of his sub-divisional subordinates, from reports and replies submitted in English for his own perusal, not interpreted by the tedious voice of a drowsy clerk, amid a dozen other distractions. The thing is quite possible. Here, as elsewhere, the French proverb holds good: It is only the first step which is formidable.

EDITORIAL NOTES.

OUR anticipation regarding the inefficiency of the fumes of burning sulphur (sulphurous acid gas), as a substitute for powdered sulphur, for the prevention of coffee leaf disease has been supported by actual experiment. Mr. Morris worked out a series of experiments with Mr. Wall's fumigating process, and found that the filaments and spores of the *Hemileia* were very little injured and recovered rapidly their vitality, after applying fumes which almost destroyed the foliage of the trees, which bears out what we said in our previous issue, *viz.*, that the sulphurous acid in its *nascent* state, is the most efficient means of destroying the vitality of the fungus.

THE annual Grant-in-aid of Rs. 1,200 to the Nagpore Agri-Horticultural Society, which the Government has contributed during the last five years, will probably be discontinued as the Chief Commissioner is of opinion that the results attained during the past five years are scarcely such, as to justify the Imperial subsidy now granted to the Society; and he thinks the Society will have no just grounds for complaint if the subsidy is withdrawn. The Chief Commissioner intends, however, to sustain the Society by such moderate grants as might to him seem necessary, from provincial funds. The Government Grant-in-aid, if withdrawn from the Society, might well be devoted towards the better carrying out of the objects of the Nagpore Experimental Farm.

A REPORT on certain crop experiments made in some districts of the Bombay Presidency during 1875-76, was forwarded to the Secretary of State in December last. In Dharwar and Canara, the

result of the experiments seem to show that the assessments on the lands in question is light compared with the gross value of the crops, the highest proportion being 6·8 per cent. in Dharwar, and 6·7 in Canara, above Ghats. In the absence, however, of information as to the probable cost of cultivation, these particulars do not show what proportion the assessment bears to the net yield of the land, which seems to be the most important fact to be ascertained: further, one year's experiments cannot produce any reliable data from which to deduce the general incidence of assessment to the yield of the land. In order to ascertain this, it is recommended by the Secretary of State that experiments should be continued annually in the same localities and under different conditions of of season.

AGRICULTURAL prospects in the Punjab are so bad that the local Government have considerad it necessary to call on all district officers to furnish early and full information on the following points:—*Ist*, prospects of standing crops; 2nd, stocks; 3rd, what works of most public utility they would recommend being started as relief-works.

THE condition of the people in Kattywar is causing considerable anxiety in Western India. Grain is almost unprocurable, or can only be bought at prices beyond the reach of the poorer classes. The formation of local relief works is being urged by the local papers to prevent the people from wandering into other districts, where they are likely to perish of starvation. A correspondent writes from Rajkote, the chief civil station of Kattywar:

"We must do something to save the cultivators who are the bone and sinew of the country, from the ruin and starvation, when they have pledged their last gold and silver bangle to raise money to feed their children. The post cart from Rajkote daily takes away the valuables and ornaments of the poor people to be sold in the Bombay markets. When they are reduced to their last rupee, the want and desolation of this district will be complete."

Two proposals for the construction of railways through the country have been under consideration for sometime. It is understood that the proposals have been approved of by the Bombay Government. No time should, therefore, be lost in providing employment for the bands of starving people who are wandering about the country.

A SMALL herd of Mysore cattle, the Amrut mahal breed, is to be sent to the districts of the Nilgiris, Coimbatore and Salem, as an experiment, to decide whether the cattle will thrive in the climate and on the natural herbage of these districts.

WE observe that the Government of Madras has given instructions that no applications for forest or shola land should be entertained on the Nilgiris until the whole district has been reported on, and the general question of land reservation, whether forest or grass land, has been considered and decided. Any such applications addressed to the Commissioner will be registered for future disposal.

FROM papers placed at our disposal, bearing on the introduction of the carob tree, we observe, that the Commissioner in Sind has distributed the carob seed among the Collectors of Kurrachee, Hyderabad, and Shikarpur, and the Conservator of Forests in Sind, with the following results:—

In the Kurrachee district the seed was sown in several places in the Jhemek, Shahbandar, and Sehwun divisions. In the latter alone the seed germinated successfully, but owing to the floods and heavy rain the seedlings were destroyed from submersion. In the Hyderabad district the experiment was tried at Salaru—the growth of the seedlings is described to be very slow, none being above 9 inches in height, but there are 180 plants in a healthy condition fit for transplanting. Besides the above some seedlings have been distributed. There is one plant already in the garden the growth of 7 years. It is 10 feet high and is not only healthy but it is stated to have made more progress this year than in any former year. In the Shikarpur district the failure was complete. The Conservator of Forests tried the experiment in the Sukkur, Nanabahra, Hyderabad, and Jerruck divisions. The result may be pronounced a failure except at Sukkur, where the surviving plants of which there are 25 out of 60 have attained the height of 5 ft. 6 in. and are thriving.

THE annual administration report of the Bombay Cotton [illegible] 1877-78 shows that during the year there was a considerable falling off in the area sown with cotton. In the northern districts of the Presidency, the rainfall at the commencement of the season was too scanty to admit of an extensive cultivation, and there was consequently a great diminution in the area sown, especially in the native States, while in Sind, owing to a deficiency of water in the Nara, and the late retention of the flood water in Thar and Parkar, there was also a decrease. In the southern districts, the rainfall was seasonable, and a greater extent of land was devoted to cotton there than in the previous year. The total area under cotton was 2,812,651 acres, or 410,586 acres less than in 1876-77. There was a net decrease of 468,428 acres in the area sown with indigenous cotton, and an increase of 57,842 acres in the cultivation of the exotic variety. The total quantity of cotton exported from the Presidency was 763,313 bales, of an estimated value of Rs. 7,28,05,307, showing a decrease of 216,514 in bales, and of Rs. 1,82,54,836 in value, as compared with the exports of 1876-77, which latter were, however, exceptionally low.

THE Chief Commissioner of Mysore and Coorg has sent Mr. Harman, Superintendent of the Bangalore Experimental Farm, on a tour through the coffee districts, to enquire into the causes of leaf-disease, and generally into the present state of coffee cultivation in Coorg. Mr. Harman appears to be going into his work heart and soul, and we have every confidence that his tour will benefit the planting community. We observe, Mr. Harman has been delivering some lectures in the Coorg Planters' Association Rooms before a considerable and appreciative audience, and has drawn *inter alias*, attention to the necessity of adopting a more rational principle of manuring, instead of the present happy-go-lucky style.

MAJOR NUTT'S agricultural fair and horse show at Songarh in Kattywar, a report of which appears elsewhere, appears to have been a great success. This is the first occasion upon which a fair of the kind was ever held in these parts, and the gathering is considered to have been very good. The Chiefs of Bhownuggur and Palitana were both present, the former presenting the prizes on the last day. The most important feature in the meeting was a course of lectures delivered by Major Nutt on agriculture. A course of study at the Agricultural College at Cirencester has made this officer quite proficient in this subject, and the zeal which has prompted him to impart his knowledge to the kunbees in such an out-of-the-way place as Songarh, is most praiseworthy indeed. Major Nutt's stay in Songarh has been a very short one, yet the improvements he has already effected in the place, as reported to us, have been very great. He has now been ordered to Baroda, and the regret expressed at his leaving Kattywar is very general. He will, however, have a large field for improvements open to him in the Gaekwar's territory.

WITH reference to the supposed discovery of the olive tree in Burmah, a correspondent sends a Ceylon contemporary the following note.—In the Forest Flora of Burmah by Kurz, four species of Olea, the genus to which the European Olive belongs, are given as natives of Burmah, *viz.*: 1. Olea dentata, Wall; with fruits the size of a small pea. 2. O. dioica, Rox. with fruits the size of a large pea. 3. O. terniflora, *viz.*, with fruits ovoid-oblong, nearly half an inch long, smooth, bluish black; and 4. O. robusta, Kurz, with small bluish black fruits, this last being equal to the Ligustrum robustum of Ceylon, where we have also the Olea glandulifera, Wal., and O. gardneri, Thw.. But it is evident from the size, &c., of the fruits of the Burmese olives, that none of them can be confounded with the European olive, and judging from the paragraph quoted, the discovery of a large edible or oil-yielding olive tree in Burmah, must be a species of mare's nest, and also that the discoverer, though he may have a vague idea of what an olive should be, is no botanist. Our Ceylon Weralus, from which Weralugstonna, in Ambagamuwa, pickled and sold in Colombo, or in their natural state in the bazaars, are very much like olives, and hence their botanical name *Elæocarpus*, but here their affinity ceases. They belong to a widely separated family of plants and the pulp of the Weralu does not contain oil.

MR. BADEN POWELL, Conservator of the Punjab Forests, has written an interesting pamphlet on some remarkable geological phenomena, known as the "chôs" or sand torrents of Hoshiarpore. The [illegible]

"chôs," induced Mr. Powell to direct his attention to the subject with the view of devising some means of checking their progress. "In one tahsil alone they calculate 35,000 acres of land covered with sand by "chôs"; it should not be forgotten that in this rich and well-peopled district, this land alone, if reclaimed, might be on our rent rolls, bringing in a yearly revenue of at least Rs. 50,000." In many other districts the same feature is noticeable. Immense quantities of ground, which, a few years ago, was under cultivation, have been devastated by these "chôs" to an almost incredible extent. The sand descends from the Hoshiarpore hills in streams which spread out in the shape of a fan as they descend to the plains. The "chôs" have even descended far down into the Jullundhur district, carrying destruction in their train. Mr. Powell gives the following description of the manner in which the masses of sand which descend in these torrents are supplied. "In the first place, the general surface of the hills is cut away, resulting in the abrupt and scarped appearance so well seen on crossing the Sutlej from Rupar. The *débris* of this is either accumulated in secondary ridges, so often observed at a short distance from the main range, or is absorbed into the current of a gradually-formed water-course. The rain-water as it flows towards the main lines of "chô" drainage is thus already charged with fine sand and mud, carried off from the surface abrasion of the hills, and thus it is already prepared to furnish a considerable amount of depositable material to the "chô." But the bulk of the supply is furnished by the giving way of the scarped surfaces of sand strata, which have been cut through by the stream, and now form its confining walls."

Mr. Powell proposes to deal with the matter by planting and artificial excavations, which will check the onward progress of the "chôs." He recommends Government to send "a trained Forest Officer to Hoshiarpore to act as Assistant to the Deputy Commissioner I would suggest that the Home authorities might be asked to select one of those now studying who has a taste for this branch of work, and let him have special opportunities of visiting such works as the reboisement near Embrum, which successfully extinguished the torrent of St. Marthe, the reboisement of the Luberon in the Department des Hautes Alpes, that of Karst in Illyria, and other such works." In course of time, some of the land may be reclaimed, and we shall no longer be presented with the picture of "mile after mile of the district cut up with the broad dry beds of sand, not only useless, but spreading their desolation further and further with every hot wind and every flood."

A RECENT number of the *Gazette of India* contains a mass of correspondence regarding the tussur silkworm. Some three or four years ago, the Government of India took up the question of "the possible development of a profitable industry in the silk of the undomesticated silk-spinning worms of India." The experiment has not been very successful, as regards either the quantity or quality of the silk. It has been brought to the notice of European manufacturers, but there appears to be little or no demand for it. The largest order received is from M. David, a silk manufacturer at St. Etienne for 2,000 kilogrammes of cocoons, "for the purpose of making experiments with the silk at his own cost." He offered to purchase them at one franc per kilogramme, but the Government could not afford to sell them at less than three or four times that amount.

In his letter giving this order, M. David asks the following questions :—

1st.—What is the chemical agent made use of by the natives to soften the cocoon and make it ready for reeling?

2nd.—Can the natives reel a cocoon more than a year old?

3rd.—What is the length of time elapsing from the making of the cocoon and the time of the coming out of the moth: does not that time vary greatly?

4th.—The cocoons in the bales are mixed in colour, dark and light: are these different varieties, and are they found on the same spots? Would it be possible to get only light-coloured ones?

The Resolution under notice requests the Lieutenant-Governor of Bengal, the Chief Commissioner of the Central Provinces, and other officials to furnish replies to these, and to other questions of a similar nature from M. Rondot, together with any other information obtainable on the subject.

WE make no apology to our readers, for publishing the following interesting extracts from a letter on the Nagpore model farm, from Mr. J. W. Neill, C.S., Commissioner, Nagpore Division, to the Secretary to the Chief Commissioner, Central Provinces :—

"I would say that while every argument which was used to demonstrate the utility of model farms in different parts of India, and amongst others at Nagpore remains unimpaired in force, there are additional reasons for maintaining a farm which has been established, for which land has been acquired, on which buildings have been erected, and to which a water channel to permit of the irrigation of part of the land has been made. In this case too the land that was taken up was naturally poor in quality, it had further been impoverished, the surface was uneven and considerably broken up, the rain water making channels for itself through many fields which sloped northwards. During the past 5 years much labour has been expended in levelling some of the fields, in deep ploughing all, in manuring a portion of the farm. It is only during the last two years that irrigation has been possible. The land has now very much improved, as was clearly evidenced by the rent of some fields let out to cultivators under circumstances explained in the half-yearly report on the farm submitted at the end of last month ; more remains to be done. All the fields are not yet in the best possible condition, and experiments on the farm have not been uniformly successful, but a fair amount of success has been achieved. Crops, unprecedentedly large in these parts of wheat and cotton have been taken off the farm, and the benefit of deep ploughing and careful cultivation has been acknowledged by surrounding agriculturists, although they have not yet taken to imitate what they admit to be good. That the example of the farm has not yet modified native practice, cannot well be construed into an argument that the farm has failed in its object. It has been established for barely five years, too short a time to effect much, even if the farm at starting had been in thorough order, the soil good, and fit for growing any kind of crops. In reality, however, the soil over a considerable part of the farm was at first incapable of supporting any but the poorest plant life.

I am disposed then to think that, if model farms in India are useful institutions, the Model Farm at Nagpore can claim a longer trial There has not been sufficient time to judge of it as an experiment. It no doubt is an expense, it costs Government about Rs. 500 a month net, but model farms are educational institutions. They do not yield direct returns, and it is in the hope of the indirect return that they are maintained. I would in conclusion express an opinion that if the farm is to be a success, the superintendent should be a man who can devote his whole time and attention to it, who has had some previous training, and has a knowledge of agricultural chemistry; and that he should be kept at his post for 5 or 6 consecutive years. If such a person were appointed, it might be possible to dispense with the native Superintendent, and in that way funds might be provided to make up the salary which would have to be given. It may be difficult, however, to find a properly qualified person, especially in India ; an ordinary gardener from England would be of no use, a young man would, I think, be required, one whose mind would be thoroughly open to new impressions, perphaps a young man who had passed through the course at Cirencester College might be secured in the first instance, and by the time his engagement expired, the agricultural colleges of Calcutta, Madras and Bombay may have trained natives and fitted them for such charges. The great difficulty is certainly in finding a good superintendent. Occasionally an officer in the Commission may be found qualified to manage the farm, but one cannot always count on that, and there is the chance that he may have to be transferred ; and the frequent change of superintendents is, I think, of all things the most to be deprecated."

We heartily concur in what Mr. Neill says, and are glad to see that the Chief Commissioner is likewise in favour of keeping the farm up, and intends placing the same in the hands of an Assistant Conservator of forests. The importation of Kew gardeners as managers of these experimental farms has, on the whole, not been successful. A proper use of the advertising columns of newspaper would, we are of opinion, result in procuring for these farms some good men, practical agriculturists, who are acquainted with native agriculture and its wants.

FURTHER experiments with the juice of the *Carica papaya*, or melon tree, have been carried out by Dr. Wittmack, of Berlin, which tend to confirm his provisional report on its energetic action as a solvent and ferment in contact with flesh or albuminous bodies. The results of his later researches may be thus summarized :—1. The juice of the *Carica papaya* is, or contains, a ferment which acts with extraordinary energy on nitrogenous bodies, and also effects the coagulation of milk in the same manner as pepsine. 2. It is distinguished from pepsine in that it acts without the addition of any free acid, and also at higher temperatures (60-65 deg. C.), and in a much shorter time. 3. Chemically the filtered juice differs from pepsine by yielding a precipitate on boiling, or on the addition of oxide of mercury, iodine, or any of the stronger mineral acids. 4. It resembles pepsine, as it occurs in the gastric juice, in being precipitated by neutral oxide of silver, or sulphate of silver, and in giving no precipitate with ferrocyanide of potassium, sulphate of copper, and chloride of iron. The *Carica papaya* being widely distributed in tropical countries, the collection of large quantities of the juice should offer no considerable difficulties, and Dr. Wittmack considers the attempt to be well worth undertaking, as this could be most advantageously employed in making meat, game, &c., tender in a short time (a point of much practical importance in hot weather), and also in dairy operations.

MR. MECHI of Tiptree writes :—" Have we forgotten Liebig? That giant of mental capacity, whose discoveries, and the theories deduced from them, have formed an imperishable basis for all agriculture everywhere and in all times. How puny and second-rate must appear, to any one who read and appreciated that great man's works, the simple practical illustrations and confirmations of his theories and dictum ; and yet these were for a long time disbelieved and opposed, but never confuted by proof of error. His mineral theory is riding now triumphant over error and prejudice, and we have at last learned the great lesson which he tried to teach us—that where are wanting in the soil the incombustible elements of plants in a suitable condition there can be no fertility of crop. Phosphate of lime and potash are now accepted as essential bases, while straw and chaff have gone to the winds, which contain the free ammonia that was for the first time only discovered there by Liebig. Is it not time—if not it never will be—when a monument shall record the immeasurable benefits which he has conferred on mankind! One rises from a profound study of his great works with a conviction that he has left little more to be done in the matter on the *Natural Laws of Husbandry*, the title of his last great work."

A ROOT show recently held in Berkshire has brought the sewage farming system forward under a somewhat more favourable aspect than has often been the case. There was, it appears, a section set apart exclusively for roots produced by this system of manuring ; and in all the five classes comprised in it the exhibits were, it is said, wonderfully fine. The first prizes all fell to the Reading farm, on which 110 tons of long red mangolds, 88 tons of golden tankard mangolds, 77 tons of yellow intermediate mangolds, and 77 tons of yellow globes were grown per acre. These are certainly very satisfactory figures ; and if sewage farming could often show such results, it would soon dispose of whatever financial difficulties have been experienced hitherto in connection with it. It ought, perhaps, to be observed that the crops exhibited were the first that have been raised on this farm, and the soil is described as 'new and fresh.' Under these circumstances exceptionally good yields were to be looked for, and perhaps would have been realized under any system securing plenty of manure. There is another alleged fact, however, which would at first sight seem to prove that no great allowance need be made for newness and freshness. On about fifty acres of the farm, it is reported, the same seed was sown, and the same culture adopted in every particular except that no sewage was applied. In this portion the crops yielded were less than half the weight of the rest. This seems to be a very conclusive test of the value of liquid manure. But it must be borne in mind that nobody has ever disputed its value, nor would any one be so foolish as to suppose that fifty acres of unmanured land could at all compete with other ground deluged from the sewers of a town. The only comparison worth anything is that between the and in a large number of cases, at least, it has been shown pretty conclusively that the difference in results is not satisfactory when cost has been taken into account. If the Reading farm and some others represented in the show referred to can maintain the crops with which they are accredited, no doubt they will be able to show very gratifying balance-sheets, and the inhabitants of Reading may be congratulated on their success in dealing with the troublesome question of sewage, even though it converts some of their neighbouring fields into spots that will be much the reverse of attractive in appearance.

AT last we appear to have something definite about the phylloxera, thanks to the International Committee, named at the Trocadero Congress, and presided over by M. Vimont. The Committee consisted of twenty-five members, six of whom where distinguished foreign vineyard proprietors ; they have examined the question from the first appearance of the malady in 1869, in the department of the Herault, down to the present moment : they noted the chief cures attempted—3,000 were sent to the Minister of Agriculture to claim the Governmental reward—and visited the suffering and the ruined vineyards. The report states the phylloxera was imported to Europe from America, and the disease can be propagated by artificial—transporting of plants—as well as by natural means—the wind chiefly. Stocks of American vines, as first revealed by M. Laliman of Bordeaux, can resist the bug ; they flourish vigorously when the native vines die ; the grafting does not in the least alter the delicate bouquet of the French grape ; but all American stocks are not equally resisting, the Solonis, Clinton Vialla, or Franklin, and Taylor being the best. The plant when attacked at the root, dies from inanition ; hence, any insect destroyer must be succeeded by a good manuring to give strength to the wounded plant ; after farm yard manure, the next best fertiliser is dried blood, with sulphates of potash and iron and superphosphates. The only efficacious insecticide is sulphuret of carbon, as first employed, on the appearance of the disease, by Baron Thenard, and abandoned owing to its severe effects. The manner of employing this remedy is now better understood : two injection holes per square yard, suffice to inundate the soil to the depth of 11 inches with the poisonous vapors, and some apply the quantity in 3 doses, at intervals of 4, 6, and 10 days. Submersing the vines drowns the bugs, but the flooding ought only to take place in autumn after all vegetation has ceased. Then the vines can support 11 inches of water, from 30 to 50 days, to be followed in spring by liberal manuring.

THE report of the Agricultural Department of the United States for the past year states that the maize crop exceeded that of 1877 by 30,000,000 bushels. The crop of oats is stated to have been the largest ever raised, and that of barley and rye was considerably in excess of that of 1877. The tobacco crop also showed improvement in quality. The averages of production as compared with 1877 are :—Kentucky, 60 ; Virginia, 73 ; Missouri, 56 ; Tennessee, 53 ; Ohio, 90 ; Maryland, 84 ; Indiana, 83 ; North Carolina, 89 ; Pennsylvania, 86 ; Illinois, 50 ; Connecticut, 86 ; Massachusetts, 95.—*British and Mercantile Gazette.*

A WRITER in an Australian paper states that in many districts of the colony the leaves of the celery are highly esteemed as food for milch cows, and are often preferred to red clover. The cows are said to eat them most greedily and to yield on this food a far sweeter and richer milk than on any other. Sometimes the leaves are cut up small, scalded with hot-water, and given as a mash mixed with bran and sometimes they are given whole in their natural state along with the other ordinary food.

THE experiments of Boussingault, Stohmann, &c., have demonstrated that, while the urine of carnivorous animals is rich in phosphoric acid, that of herbivorous animals has rarely any. Liebig accounted for the absence, by the alkalis of the urine being unable to dissolve the phosphates of lime and magnesia. At the University of Leipsic, some experiments were recently executed to call in question Liebig's explanation ; from which it follows, that when a herbivorous animal is submitted to its ordinary dietary, the liberated phosphoric acid is eliminated, not in

rich in alkalis, united with carbonic acid, which cannot dissolve the lime phosphates, and so allow its acid to pass off; but if phosphates of potassium be added to the forage, the phosphoric will be eliminated freely in the urine.

In India, Algeria, and certain parts of the southern provinces of Italy, the *Pelargonium rosatum* is grown upon an enormous scale, for the sake of an oil extractable from it very similar in odour to that of roses, and which constitutes an important article of commerce. This industry has of late been very injuriously affected by the adulteration of the genuine oil by the addition of liquid hydrocarbons, fixed oils, essence of copaiba, and similar substances, whereby its value in pharmacy, and for the preparations of perfumery, is greatly diminished. The *L'Italia Agricola* publishes the particulars of a simple test by which such adulteration may be readily detected. Five cubic centimetres of alcohol, of 70 deg. strength, are poured into a test-tube, six drops of the suspected essence added to it, and the whole well shaken. If the liquid remains clear it is a proof that the essence is pure, but the occurrence of the least turpidity indicates adulteration, owing to the fact that alcohol, of the strength named, will not completely dissolve the foreign substance or substances, and their presence in an undissolved state causes the turbid appearance of the liquid.

Some official papers received by a recent mail, describe the difficulties encountered in the suppression of the cultivation of the poppy in China. Notwithstanding fines and Imperial edicts against its growth and consumption, the result appears to be that more and more opium is produced and used each year. In some provinces very stringent measures are taken to suppress it, whilst others are overrun with the poppy, special dues being levied both on the land given to its cultivation and the drug produced. Then, again, the Chinese cultivators have discovered that the poppy is an exceedingly remunerative crop, and the local authorities seem to be not altogether indifferent to the fact either, for from the fines and bribes connected with the production it is believed that they reap a profitable harvest. In some respects, the higher authorities are powerless to act, for if they attempt to carry out the Imperial decrees, they are informed that to interfere with the crops will so impoverish the land-owners as to make the collection of the Imperial land-tax impossible.

M. Srupp, a German farmer, desiring to test the relative fattening qualities of rice and maize, tied up 18 bullocks in November 1877, in three lots of 7, 6, and 5 beasts respectively, and as nearly as possible under the same conditions as to age, weight, &c. The feeding was the same, save that the rations of grain, 6½lbs. daily, and in the form of flour, consisted of maize, oats, and rice. He found that 85lbs. of the latter exercised the same nutritive effect, as 100 of maize.

Messrs. Palmieri, Celi, and Grandeau have conducted experiments to test the effect of electricity on vegetation; they proved that in the case of maize and tobacco, the plants grown in full air developed with double the rapidity when exposed to the electrical conditions of the ordinary atmosphere. But it remained to determine effects in the flowering and maturing of the plants. M. Grandeau shows by his experiments, that the same rate of superiority, 50 per cent., was maintained, respecting the flowers and seeds of tobacco and maize, as was exhibited formerly in their growth.

For ages it has been known that solar light is indispensable to vegetation, and efforts have been several times attempted to secure the best conditions for plants exposed to solar action. The colours of plants have been modified, by moderating the intensity of the light to which they have been subjected; hence resulted the experiments, to determine what were the exact rays of light most directly beneficial to vegetation, as revealed by placing plants under glass of various colours. M. Paul Best has continued experiments on this subject, and while the problem is not exactly solved, he has demonstrated that they are the red rays which form the basis of the phenomena of vegetable life—transforming food, and building tissue; while the united rays that constitute white

A writer in the *Bulletin de la Société d' Acclimatation de Paris* record the results of a number of experiments with quinine sulphate on diseased silk-worms. A commission which reported on this subject in 1859 stated that silk worms treated with quinine or gentian never exhibited the same symptoms of cure observed in others which had taken either mustard or valerian; but Mr. Christan Le Doux, being in ignorance of this statement, has made further experiments, with satisfactory results. Worms suffering from *flackerie* were powdered with quinine, and nearly all recovered in a very short time after the application. Some very bad cases of *pebrine*, with open putrid wounds, were successfully treated in the same manner.

After finishing his Wynaad surveys, Mr. Brough Smyth is requested to proceed to Ootacamund and complete the investigation of the Nilgiri and Koondah Hills and their surroundings and then go to Canara and any other Madras districts which may be hereafter indicated. His services will then be at the disposal of the Government of India for the exploration of the Mysore gold fields. The illness of Mr. Withers and Mr. Thomas Laing has to some extent interrupted Mr. Smyth's labors. Mr. Laing is again unwell, and is not in a fit state to assist in the work which Mr. Smyth has in hand.

COMMUNICATED AND SELECTED.

THE ARGAN TREE OF MOROCCO.

The following extract from a report by Consul Drummond Hay on this tree has been placed at our disposal :—

"Considerable damage was done to the crops of 1877 by the locusts whose appearance in this part of the country was mentioned in my report for 1876, but as their devastating flight was limited only to a certain line of country, many provinces escaped the scourge. The prospects for the harvest of 1878 are at present very unsatisfactory.

Since the first rains in September only three inches of rain have fallen in Mogador and, it is reported, still less in Soos and the country lying between this port and Morocco. Cattle in the interior are starving for want of grass, and can be bought in the market for the value of their skins. In the neighbouring provinces of Haha and Spiedma the drought will be less felt as they are thickly wooded, and the forests of argan trees above all afford nourishment both for the natives and their flocks in times of scarcity.

This remarkable tree grows only in those provinces and Soos, and is utilised in the following ways. In the first place, the peasants extract an oil from the nut, which is useful both for burning and cooking purposes. When the nuts ripen and fall off the trees they are collected by the natives, who are aided in the harvest by their goats. These animals swallow the fruit for the rind, but, being unable to digest the nut, they throw it up again, and it is then added by their owners to the store for making the oil.

For their private consumption the peasants rarely make a large quantity of oil at a time, but crack open a few handfuls of nuts with a stone, and, after toasting the kernels in an earthenware dish, grind them into flour. The oil is extracted by adding water in small quantities to the flour, which is stirred in a bowl. As the oil is being formed by this process, the flour hardens into a cake, which is finally squeezed, leaving the oil perfectly clear and fit for use. This kind of oil-cake then serves as an excellent food for cattle, as also the dry rind of the nut, which is generally given to them with the cake, forming together their principal and most nutritious food during the year, and is invaluable to the natives in time of drought, for the argan tree is very hardy, and a dry year has little if any effect upon it.

Even the empty husk of the nut, when broken, is not thrown away by the peasants, but used as fuel. The best charcoal is made from the argan tree, and the dry timber is excellent firewood. The goats feed also upon the leaves of the tree, and when browsing in the argan forest may be seen climbing amongst the trees, plucking and nibbling the nuts and leaves.

MEMORANDUM BY DR. G. BIRDWOOD, C.S.I.

I had already made inquiries about the argan tree, and have learned from Professor T. Dyer that it is the *Argania sideroxylon* of botanists, one of the *sapotaceæ*, an order to which many well known Indian trees, both naturalized and indigenous, belong.

The indigenous species in Bombay are *chrysophyllum roxburghee* "turséphul;" *sapota tomentosa* "koombul"; *Isonandra caudolliana*, a tree of the same genus as the gutta percha tree; *Bassia latifolia*, the celebrated mowah, from the flours of which mowah spirit is distilled, and from the seeds of which a large quantity of oil is obtained, used for making soap in the Kaira zillah, and the wood of which is used for the naves of wheels; *Mimusops elengi*, "buckool"; and *mimusops hexandra*, "kurnee," the tough close grained wood of which is used for making sugar-mills.

The introduced species are *Chrysophyllum pomiforme* from Jamaica; *Mocarpus edulis* from Otaheite; *kunki* from the Moluccas, and *Achras sapota*, the sapota plum of South America, which has become thoroughly naturalised in Western India, and yields a fine dessert fruit, the size and shape of a quince, covered with a rich brown rough rind very sweet to the taste, and containing two or three large smooth chestnut coloured seeds yielding oil.

There is every likelihood, therefore, of the argan tree succeeding in India. In what localities it would succeed best it would be difficult to say beforehand, with any certainty. Morocco consists of the southern slopes of the Atlas range, which stretches in a curve from Cape Gher on the Atlantic to Cape Deir, opposite to Gibraltar, and falls from an elevation of 16,000 feet to the low lands in a succession of terraces exposed to the full influence of of the North-west wind laden with the moisture it has gathered for more than a thousand leagues in its way across the North Atlantic Ocean. The natural heat of the country lying so near the Tropic of Cancer is, therefore, tempered both by the rain-clouds, which hang over it from October to February, and during the spring and summer months by the south wind, which comes over the snow which lies perpetually on the summits of the minor range of the Atlas mountains, producing one of the most agreeable and fruitful climates in the world. The littoral vegetation is that of the Mediterranean generally. The olive, laurel, citron, almond, and fig, and the myrtle, cyprus, oleander, white poplar, and aloe, grow everywhere; while the minor uplands (slopes and valleys) are covered with dense forests of tropical trees. Taking these physical facts into consideration, and the cosmopolitan character of the order, and the fact that innumerable African plants, both Mediterranean and tropical, have become completely naturalized in India, it is probable that the argan tree also will flourish in India, everywhere but most in sub-alpine tracts exposed to the sea breeze and an annual rainfall of from 50 to 25 inches.

It would be most useful of course to encourage its growth in districts exposed to droughts.

It will be observed, however that it is very similar in its economic properties to the mowah tree and sapota plum. The mowah is one of the noblest native forest trees of India and is plentiful everywhere in Western India, at least in the Concans, on the Ghats, in Guzerat, and Rajwara, and if more of a tree like the argan is wanted in India, it would probably be more profitable to encourage the extended cultivation of the indigenous mowah, than to squander money and time in the attempt, which might after all prove vain to introduce a new and imperfectly known exotic.

GEORGE BIRDWOOD.

30th August 1878

Mogador, 1st November 1878.

Extract Despatch from Her Majesty's Consul at Mogador.

The season here for sowing the argan nut is during the winter months; it does not take longer to sprout than a melon seed. The tree is quite indigenous to this part of Morocco, growing only in the hilly districts lying south of the river Tensift (near to Suffee), and I am informed that all endeavours to cultivate the tree in any other part of the country have failed. The soil in which the tree thrives is composed chiefly of limestone and sand. It will grow in very rocky and strong ground, but I have noticed that the finest and most fruitful trees are those which grow in cultivated ground.

Samples of the oil cake and dry rind of the nut upon which cattle are fed might interest persons desirous of cultivating the tree, and I should have no difficulty in procuring and forwarding them if required.

A. DRUMMOND HAY.

REPORT BY DR. G. BIRDWOOD, C.S.I.

I have examined these seeds. They are in prime condition, and if forwarded to India forthwith by the out-going mail will arrive at the most favourable time for sowing them, at least in Bombay. They should be sent in the bag in which they have come, laid in a strong deal box. Copies of all the papers relating to them should be sent with them for the guidance of those to whom the rearing of the trees will be entrusted. I would venture also to suggest that they should be addressed to Bombay, from where they would be most conveniently distributed to the rest of ....

GEO. BIRDWOOD.

17th December 1878.

AGRICULTURAL MEETING AND CATTLE FAIR AT SONGAD, KATTYWAR.

THE following account of this gathering will be perused with interest:—

According to announcement the above assemblage of men and animals, together with a large collection of things, was held at Songad on the 13th, 14th and 15th February. The title chosen for the proceedings is too modest. It was really a good agricultural exhibition, though the first of its kind that has taken place in these regions. Major Nutt seems to have the enviable power not only of originating new things, but also of influencing large bodies of men and bringing them over to his own opinions; and he certainly is to be congratulated on the success of this enterprize, which owed its conception to his own brain and its accomplishment to his peculiar tact, energy, and administrative ability. It is pleasant also to know that his scheme was heartily seconded by liberal contributions of money and other forms of help from the neighbouring Chiefs, particularly those of Bhawnagar and Palitana, both of whom were present on the occasion and took a deep interest in the whole proceedings.

Songad is well situated for such an exhibition. It has an attractive and healthy situation, and is supplied with abundance of running and well water of the best quality. A capital macadamised road, branching out to Palitana, Rajkot, Bhownuggur, and Gogo, furnishes additional advantages for a large gathering of men and agricultural products. A large grove of mango trees skirting the banks of a pretty stream, afforded by its excellent shade an admirable camping ground and protection on this occasion for the long rows of horses, buffaloes, bullocks, and other animals which were tied under its branches. From the road a broad avenue, lined on each side with gay flags and devices, ran down to the encampment, and with its crowds of men and rows of busy shops had a most interesting and business-like appearance. The fair was altogether a new thing for Songad and will long be remembered and talked of by hundreds of families throughout a radius of 50 or 60 miles. Even Surat, across the gulf, was represented, and some of its enterprising Parsis exhibited first class specimens of fruit, vegetables, and grain. Such exhibitions must do a world of good in the improvement of agricultural products, the elevation of cattle-breeds, and the general international and political benefits arising from the free intercourse of different Chiefs and the competition of different States cannot but be of the most salutary character. The proceedings of the Exhibition were arranged as follows:—

FIRST DAY

At noon Major Nutt very appropriately inaugurated the business by a carefully prepared lecture on "Soils," delivered first in English and then in Gujarati, in a spacious tent, before an audience of nearly three hundred, including several Chiefs and a large number of other native gentlemen; and the earnest attention which was given to every sentence evidenced not merely the novelty of the subject, but the absorbing interest taken in it. It is questionable if five persons of the native audience had ever before dreamt that so much could be accurately known of the components of the soil they have been so long treading and trying to make profitable. The subject was divided into six sections—namely, the origin, the formation, the distribution, the physical properties and surrounding conditions, the classification, and the chemical composition of soils. The entire mineral matter of soils, the lecturer said, has been derived from the gradual decay of rocks, the process going on from age to age through unnumbered years, and being still in active operation. The process is caused by various agents, such as temperature, moisture, and the action of the atmosphere and vegetation. The first product of pulverised rock is lichens, then mosses and grass, then higher forms of vegetation as the moistened dust becomes more and more mixed with organic matter. The physical nature and productive powers of a soil depend on the proportion in which its constituent parts are blended; those constituent parts being sand, clay, lime, vegetable matter, and mineral fragments or stones. Hence it is the duty of the farmer to ascertain the elements of which his soil is composed and their proportion to one another and select his manure and his seed accordingly. To prove that his advice meant more than talk, Major Nutt volunteered to have all samples of soil sent to him for analysis thoroughly tested by a professional chemist, and brought an extremely useful lecture to a close by urging his agricultural hearers to turn over a new leaf by going deeper down and turning up the virgin soil that has lain undisturbed in almost every field in India since no one knows when, waiting only to be brought to the surface to prove its native strength by producing heavier and richer crops. This was much-needed counsel, for the native cultivator seems never to have heard the burden of the good old rhyme,

> Plough *deep* while sluggards sleep,
> And you'll have plenty of corn to sow and to reap,
> And plenty of money to spend and to keep.

The next part of the first day's work was the judging of grains, vegetable, and fruits. There was a very good show of these products, and many specimens were of a high character. Among grains it was noticeable that a Christian colony near Gogo had introduced several kinds into Kattywar, which had hitherto been unknown, except in the shops, and had introduced them most successfully. It was commonly believed that these sorts were not adapted to Kattywar soil. The fruit and vegetable stalls also showed marks of enterprise and advance in the form of foreign products, among which the potato, cabbage, tomato, turnip, salad, and English apple were conspicuous. The gardens of the Bhownuggur Darbar carried off most prizes but other States and private gardeners had also a share. Some of the fruit and vegetables, both native and foreign, were exceedingly fine.

Second Day.

The business of the second day opened with inspection of animals and deciding on their respective merits. The show of horses was exceptionally good, and well sustained the character of Kattywar as a breeding province. It comprised the celebrated pure Kathy horse "Reddo," the property of the Thakore of Bhownuggur, and the equally well-known "Anstey," a thorough-bred Arab of 15 hands in height, the property of the Thakore of Palitana. Both these horses were universally admired. It was a ticklish point, I am told, to decide which of the two should have the first prize, for they are both A 1 specimens of their respective classes. Ultimately it was agreed to place "Reddo" at the head of the list, rather in consideration of the meeting being especially for the improvement of the indigenous breed than for any superiority the Kathy had over his Arab compeer as first class animals.

Among the mares there were none of the country-bred of such excellence as to surpass the imported mares of the Thakore of Palitana, one of which, a high caste Arab, had been obtained by him direct from Arabia at great expense and by means of a good deal of tact and diplomacy with an Arab Chief. Horse-breeding is quite a passion with the Palitana Thakore, and he had good reason to feel proud at the exclamations of high approval which some of his home-bred stock drew forth. The Arab mare above mentioned is now in foal by "Anstey," so that the produce will be first class. There was a good show of "Reddo's" offspring, a very fair proportion of which secured prizes. They resemble their sire in all respects, except the hind quarters, which, in the opinion of some, lack proper development; but the Thakore of Bhownuggur must be congratulated on the point of perfection already attained by him in this most important matter of horse-breeding. He and the Thakore of Palitana had each about 30 horses for competition, and both gained several prizes. It is worthy of note, however, that neither of the Thakores took the prizes to which they were entitled, but generously left them to be distributed among private winners. This, together with the abundant supply of grass furnished to all exhibitors gratis, shows that these Chiefs take enlightened views of the duty of rulers, encouraging their subjects and advancing the interests of their States even at their own personal expense.

The show of buffaloes cannot be overlooked, for it embraced some remarkable samples of a breed of buffaloes hardly to be met with elsewhere than in Kattywar or Guzerat. These belonged to the Thakore of Bhownuggur. The main peculiarity of this breed is not so much the enormous size of their bodies or the quantity of milk they give (a maund a day), as a most singular formation of head and horns. A large mass of redundant flesh rests on the crown, extending down on both sides of the face like a huge hood, and, in some cases, almost completely covering the eyes. The horns, which are extraordinarily broad and thick, seem to grow out of the lower edges of the hood downwards and then turn up with a lateral twist towards the shoulder, forming sometimes almost a complete circle. A distinguished lady from London, Miss North, who is now making a sketching tour through India and who happened to be at Songad at the time, could not resist the temptation of having a "sitting" from these marvellous-looking brutes and in a very short time dashed off a splendid oil-painting of a group. So we may meet the Bhownuggur buffaloes again—perhaps even in the *Graphic*.

Bullocks elephants, camels, sheep, goats, donkeys and poultry, all had a place at the Exhibition and shared in the honour and benefit of prize-taking.

At 3 o'clock P. M., Major Nutt resumed his course of lectures, the subject this day being "Manures." The large increase in the audience at this lecture evidenced the high appreciation of the previous one. The enormous tent was almost completely filled, the numbers present being not less than 400 persons. The subject was treated under two heads, "General Manures" and "Special Manures." All manures being nothing more nor less than plant food, general manures are those which repair the entire loss sustained by the soil in the production of all kinds of plants, and, through them, of animal matter. Such manures bear a similar relation to soil products that milk, which is a general food of animals, bears to the animal body, *i. e.*, a tissue-builder. The best of these manures is cow-dung, which, it is to be regretted, is so largely used in this country as fuel. This is a most important consideration, and points to the great desirability of extra effort for the supply of wood or other species of fuel. Who can estimate the amount of loss to agriculture caused by this universal waste of the best manure which can be given to the soil? In this view of the matter, every man who plants a tree is not merely increasing the shade-comfort of his fellows, the supply of timber, and, according to current theories, of rain, but is also, though unconsciously, adding to the fertility of the soil by in so far diminishing the necessity of burning cow droppings. In the same way the introduction of coal, if possible, would tell powerfully on the agricultural products of the country. These are thoughts which are capable of large expansion and might perhaps even connect themselves with the all-absorbing famine question.

Special manures are those which repair only particular wastes from special crops, or supply particular defects in the soil itself. Liebig's well-known "Law of Minimum" was explained and urged on the consideration of the audience. The teaching of this law is that, as every field contains a maximum of one or several, and a minimum of one or several nutritive substances, and that it is by the minimum that crops are governed the way to obtain the best crops is, after ascertaining the elements of a given soil, to add to it such kind of manure as will supply the elements most defective. A large quantity of excellent manure may be put into a field, but owing to its richness in certain elements with which the soil is already charged, or its deficiency in certain elements in which the soil is already deficient, profitless expense and disappointment only are the result. Towards the close of the lecture Major Nutt referred to the very fertilising property of bones used as a manure, and entreated his audience not only to prevent the removal and exportation of bones from their villages which had now begun, but to carefully preserve and turn them into manure; and the lecture was closed with an experiment in making bone manure in the presence of the crowd. The simplicity of the process showed that any man of ordinary intelligence could easily make artificial manure for himself and that, too, at the trifling cost of a little sulphuric acid.

The most important proceeding of the day was a ploughing match. No less than 40 ploughs and pairs of bullocks stood at their posts waiting the first sound of the gong to start them to work, and immediately the sound was heard a most spirited competition began and was maintained for half an hour, the allotted time. Some of the ploughing was very good, but still the great defect of the native plough and system of ploughing were evident in almost every allotment. In one lot only were there marks of a decided improvement. This was ploughed with a light English plough adapted to India, and brought from the Christian colony already referred to. In this lot the furrows were deep and wide, and the soil thoroughly broken, turned completely over, and left exposed to the atmosphere. This plough was the admiration of all, and the desirability of generally adopting it was freely expressed by the crowds that gathered around and watched it at work. The same kind of plough has been in use for several years in another Christian colony near Ahmedabad where more than twenty are now employed, and where its superiority over the native instrument has been clearly established. A specimen of the English harrow from the Gogo colony also was exhibited and highly commended. The proceedings of this day were wound up in the evening by a moderate display of fireworks.

Third Day.

The work of the third and last day consisted in fresh experiments with the English plough and harrow, the delivery of the third lecture, the general parade of prize animals, and the distribution of prizes which was kindly undertaken by the Thakore of Bhownuggur. The third lecture was a practical summary of the preceding two with an explanation of the principles of the horse-breeding and illustrations of the advantages to be derived from it superadded. It may be suggested to Major Nutt that he might kindly allow these lectures, in their Guzerati dress at least, to be printed *in extenso* in some of the Vernacular papers. They would do more good to the country than a large amount of the matter which these journals are continually sending forth, and being in Guzerati, would be read by large numbers of natives.

It is to be earnestly hoped that this is only the first of a long series of such exhibitions in this part of Kattywar, rehearsed at intervals as short as possible, advocated by the press, and heartily aided by Political Agents and Native Chiefs.

THE CEREALS ON THE HIMALAYAS.

Memoranda on the Cultivation of Wheat and some other Food Grains in the Himalayas.

Grown at an average elevation of 6,400 feet, having a range of 1,000 below and above it. Situation, Koteghur, near Simla.

THE fields are situated at a distance from the villagers' cattle styes (*khood*) and therefore have been but seldom manured within the past thirty years, so that they are considerably reduced in their productive powers. They are on the N slope with the aspect (generally) W. by N. The soil is of a good thickness; chiefly argillaceous, overlying micaceous-schist rock; drainage perfect.

The fields were rented to the villagers on the usual local custom *adha per*, that is, on half shares; the land-owner obtains one-half of the crop, the cultivator the other half. Under this arrangement the land-owner lends the land, while the cultivator finds the seed and also provides all the labour and implements necessary for ploughing, sowing, reaping and threshing out, delivery being taken at the threshing-floor. It is necessary to add that the seed-grain is first of all deducted from the new crop (*Bithu*—Chenopodium sp. excepted) after which the division of the crop is made. Where the cultivators are very poor, the seed has been advanced to them without any interest.

Some local Weights and Measures.—The inhabitants reckon the seed required for and the outturn of their fields in *bhars* and *patis* (or *tatis*) the measures for the different crops not only vary in size, but also in weight, though the standard *bhar* may be taken to consist of 32 seers *pucka* (2½ lbs avoirdupois to the seer.) In all cases though 16 *patis* = 1 *bhar*.

The bhar measure for	Wheat, Indian Corn & Kolth	=	32	srs.	(80lbs. Av.)
" "	Barley, ...	... =	24	"	"
" "	Rice (*Keri* or coarse description)	=	25	"	"
" "	" (*Basmati* or table ")	=	21	"	"
20 pattis of	Wheat, Indian Corn and Kolth make		1	md.	"
27 "	Barley	... =	1	"	"
25½ "	Rice (*Keri* or coarse description)	.. =	1	"	"
30½ "	" (*Basmati* or table ")	... =	1	"	"

Note.—One part of basmati is reckoned equal to two parts of coarse rice.

A *mun weighs* 16 *seers* (32 lbs. avoirdupois): 2½ *mun* = 1 *maund* (80 lbs. avoirdupois.) The *mun* is also frequently designated "kucha maund." A *kucha seer* = 6¼ *pucka chittaks* (about 13½ avoirdupois) = 16 *kucha seers* = 1 *mun*. A *patti* is 2 seers in weight = 4 lbs. Avoirdupois.

(Extract from the Grain Fields Book.)

Date of letting.	Name of Field.	To whom let.	Crops to be sown.	Quantity of seed sown. Mds.	Quantity of seed sown. Srs.	Out-turn. Mds.	Out-turn. Srs.	Proportion to Self including seed. Mds.	Proportion to Self including seed. Srs.	Proportion to Cultivator including seed. Mds.	Proportion to Cultivator including seed. Srs.	Flood or No. of times of yield.	Equal to bushels per acre.	Date when reaped.	Field Ledger folio.	Remarks.
1875.														1876.		
June 8	Kadshu's Dimri ...	Purzah ...	Local White Wheat	1	30	12	12	7	9	5	12	7	10½	May 27		My seed.
Aug. 28	Jebber's Kraltu ...	Ozbu ...	Ditto ...	0	22	2	2	1	12	0	30	4¼	6	June 26		Do.
,, 26	Daud Nantu's Melela	Daud Hatu	Ditto ...	0	8½	1	22	0	35	0	27	7½	11½	,, 12	•	Do.
Sept. 2	Naphthali's Swargard	Tooi ...	Ditto ...	0	16	1	36	1	6	0	30	5	7½	,, 8		Do.
	Joseph Saria's Melela	Ploughed,														
	Nirimdoss' ,,	sown, and														
	Bini's Bermut ...	reaped by	Ditto ...	8	18	23	24	23	24	...	...	7	10½	May 29		Do.
	Nirimdoss' ,,	ourselves.	Barley ...	1	26	9	24	9	24	...	...	6	9	,, 10		Do.
Oct. 20	Kadshu's Storehouse		Pedigree Wheat ...	0	4	1	24	1	24	...	...	16	24	June 12		Do. A very small field, especially manured.
	,, Nali ...	Ditto ...		0	6	0	2	0	2	...	...	...	...	......		Do. Soil quite exhausted.
	,, ,, ...		Local White Wheat	0	13	1	15	1	15	...	...	4	6	......		Do.
	,, ,, ...		Barley ...	2	4	10	26	10	26	...	...	5	7½	May 17		Do.
Nov. 9	,, Sanjah ...	Ditto ...	Local White Wheat	2	20	9	32	9	32	...	...	4	6	,, 8		Do. Grown on rice-land without artificial irrigation Situated down in the valley.
								67	0							
1876.														1877.		
		Daud Hatu	Pedigree Wheat ...	0	8	0	15	0	11½	0	3½	2	8	......		My seed.
Sept. 1	Daud Nantu's Melela	Ploughed,	Ditto ...	0	4	1	23	1	23	.	..	16	24	June 25		Do. A very small field, especially manured.
Oct. 16	Kadshu's Storehouse	sown, and														
	,, Nali ...	reaped by	Ditto ...	0	31	3	16									
	,, ,, ...	ourselves.	Local White Wheat	0	26			...	...	...	...	1½	2	......		Do. Soil poor.
	Joseph Saria's Melela		Ditto ...	1	9	...	...	.	..	...	...	...	..	... ..		Do. Soil poor.
Nov. 4	Bini's ,, ...	Ditto ...	Barley ...	0	15	...	...	...	...	...	...	...	..	.....		Do. Sown rather late.
														1876.		
	Kadshu's Sanja ...	Chappi ..	Common Rice ...	2	20	35	0	19	15	15	25	14	21	Oct. 27		His seed. Out-turn would have been half as much again, had the cultivator not missed one the (last) watering, through being down with fever. In this instance the contractor agreed to give me 55 *bhars* of common rice, he taking the surplus as his own share; the *basmati* being reckoned the equivalent of double its measure in common rice in the usual manner.
	,, ,, ...	Ditto ...	Basmati do. ...	0	10½	3	6	8	6	...	...	12½	18	......		
								24	15½							
1877.														1877.		
May 8	Kadshu's Parade ...	Yuhanna ...	Indian Corn ...	0	14	18	21	6	25	6	39	39	60	Sept. 2		His seed. Field dug 2 ft. and manured.
														1878.		
July 7	Joseph Saria's Melela and Bermut ..	Joseph Saria	Red Wheat ...	1	20	3	20	2	27	0	33	2	3	July 3		My seed.
			Red & White Wheat	0	12											
	Kadshu's Nali ...		Barley ...	1	5	8	18	4	8	4	10	8½	13	May 23		Seed between both.
	,, ,, ...															
,, 14	Niku's Melela	Daud Hatu	Red Wheat ...	0	28	2	12	1	24	0	28	2½	4	July 1		My seed.
	Daud Nantu's Melela		Ditto ...	0	8											
Aug. 21	Kadshu's Parade .. (North End)	Adam ...	White Wheat ...	0	30	6	8	2	26	3	22	7	10½	June 17		His seed.
,, 24	Daud Nantu's Melela	Yakub Dhobie	Red do. ...	0	32	2	36	1	2	1	34	3	4½	July 3		Do Soil shaliferous.
,, 25	Kadshu's Parade .. (South End)	Nurpat and Yuhana ...	Pedigree do ...	2		8	32	5	16	3	16	4¼	6½	June 28		My seed.
,, 29	Joseph Saria's Matad-har	Cherenklu ...	Red do. ...	0	32	1	22	0	10	1	12	2	3	July 12		His seed. This field was let on "one-third" crop Bushel of wheat = 60lbs. avoir.
								24	18							

From this book the items are transferred into the Field Ledger wherein each field has its own heading, and by means of which the rotation of crops, manuring, and other agricultural operations can be regularly recorded.

The villager's "J... " fields are much more productive (12-16 fold = 18-24 bushels* per acre) owing to their proximity to the cattle-styes, where they can be readily manured: These fields also yield two crops in the year, i. e., one crop of cereals, and one crop of millet, peas, &c.

Sundry Notes.—It is not advisable to manure the land before sowing the seed as it produces too rapid a growth, weakening the straw, (known by the term "running to straw") and increasing its quantity at the expense of the ear, which does not attain its proper development. The best time for manuring is just before the December rain falls as it is then well washed into and mixed with the soil.

The wheat is ripe when the straw is dry and yellow below ear, if then cut the largest yield of flour is obtained.

The difference in colour between the red and white wheats is owing chiefly to the soil; the latter gradually becoming darker and ultimately red in some stiff wet soils; and the former lose their colour, becoming first yellow and then white on rich, light and mellow soils.

Some of the zemindars add to their incomes by lending out seed on 25 per cent. interest, i.e., for each maund of seed lent 1¼ maund is returned, at the succeeding harvest.

The outturn (Proportion to Self) is entered into a Grain Ledger (left handside), while on the right the issues or sales are entered, and from this book the money from the sales is passed into the Cash Book, ... of grain only takes placeon Saturday afternoons, at the same time that the labourers recieve their wages.

CALLOPHYLLUM INOPHYLLUM.

AMONG the successful experiments carried on by that most useful of local institutions—the Agri-Horticultural Society of British Burma—with seeds of useful economic plants, is that of raising in a small nursery a number of seedlings of the *Callophyllum Inophyllum*. The plants so raised were reported some time ago as being in a healthy condition promising well.

This species of the *Callophyllum* is a valuable oil-yielder, and a native of the East Indies. It was first brought to the notice of the botanical world in the year 1793; but in the East it has long been known and esteemed for the oil it yields. In Southern India this oil is known as *poonnay* or *poon*; in Orissa as *poonung*; and in Hindoostan as *sur-pun-ka-tel*. The genus comprises large growing timber trees, and the species *Inophyllum*, in addition to yielding the famous oil, gives a timber, which Dr. Balfour, quoting Mr. Dalrymple, says, is superior to the yield of nearly every other tree for the knees of ships, and as crooks in general. In some parts of India and Ceylon the wood is used for masts, and cross-sticks in native cargo and fishing boats, as well as for bullock-cart poles. A cubic foot of it weighs 40 lbs. It is thus lighter than teak; almost of the same weight as red pine, jackwood, and the Nassau species of mahogany; and heavier than larch, chesnut, fir and elm, though not the Canadian growth of the last. The graining of the wood is coarse; but the wood itself is very strong, durable and ornamental, and is used at times in ship-building in Madras.

Apart from its oil and timber, the tree is in great request both for its beautiful leaves and sweet-scented flowers. The former, in technical language, are described as opposite, simple, coriaceous, shining, close veined, entire; the latter (the flowers, as auxillary, drooping, in racemes, fragrant, white, polygamous. Such a description, however, will hardly afford the lay reader an adequate idea of either the beauty of the foliage or the sweetness of the flowers. It needs but a sight of the former to distinguish them ever aftewards, as they are unlike most leaves, oval in shape, of a dark shining green, quite leathery to the feel, and their veins run close to each other in clear, distinct, almost parallel, lines, while a well defined vein forms a margin all round. In Java they are grown principally for the shade they afford and the scent of their flowers. Here, in Burma, Dr. Mason tells us, that specimens might be seen in the vicinity of the native monasteries, and that they are remarkably handsome plants. Their easy rapid culture is no small recommendation. Seedlings, as a rule, are not transplanted, but put down in chosen sites and there the plants remain for the rest of their existence after sprouting. Writing from personal knowledge of this beautiful plant, we can state, that the seedlings are not injured by transplanting from the nursery to a locality selected for them; and some of the handsomest plants in the gardens of Calcutta have been so treated. The best plan, we have found answer, is to let the seeds drop from the branches on the soil underneath and germinate there, afterwards to transplant when the seedlings are a few inches high.

The plant loves the sea-breeze and thrives within the radius of its influence much better than anywhere else, no matter how favorable the locality in other respects. It delights in a rather sandy soil, and from this we are led to believe Rangoon and its vicinity will be found suited to its growth and culture. Indeed some plants here are quite as good as the best we have seen in India. As to methods of propagation, that from seed is to be preferred to cuttings, though these root freely in sand under a bell-glass.

Its notice here, however, is not for the purpose of advocating its adoption as a shade-giver, or garden ornament: it is from an economic stand-point that attention is drawn to it. The cultivation of the plant might with advantage become a local industry. Thus viewed, the oil is its most valuable yield, and the seeds are said by some to give sixty per cent. of their weight in oil. Castor, however, highly oleaginous as are its seeds, yields only about a third; and the produce from the *Callophyllum Inophyllum* may be set down at that mark too, especially as it is currently reported amongst natives, who do extract the oil, that this rate is usually obtained. The uses to which it is put are not many. It is used medicinally, but not culinarily; for lighting, but not for lubricating. It is never put into the cooking pot, nor is its cake given to cattle. But *khoberajes*, or native physicians, prescribe it for rheumatism, and the Indian dâk-runner saturates a bunch of leaves with it for a torch wherewith to scare away wild animals as he speeds on his jingling way through jungles and topes, carrying mail-bags. Medicinally its use is extremely doubtful, as the British Pharmacopœia is silent regarding it, and our druggists are ignorant about it. The chances are its efficacy in rheumatism is owing more to the friction employed in rubbing it in than to any inherent specific virtue. As sold in the bazaars of India and Burma, the oil is a crude substance, seldom if ever refined, and best suited to burning. As such, it ought to possess a value here where cocoanut and castor-oil are both so high-priced. In India—in the Hill States and in Calcutta,—a maund fetches Rs. 10; but some official papers regarding it state, that in Kyouk-Phyoo as much as Rs. 40 is obtained for the same weight. The use of the hydraulic press would, we fancy, procure a clearer, at least a better-looking produce in place of the dirty, greenish color, and the body instead of being opaque through impurities, would be limpid, just as "cold drawn" castor-oil. A few experiments might be tried in this direction.

Its timber is also another object for its extended cultivation. The local government has not neglected the matter, as we are informed experimental cultivation with it has been tried in some of our jails—Kyouk Phyoo particularly. But the local administration has ceased to publish papers of such nature in the Supplements to the *British Burma Gazette*, and it is hard to get departmental officers to communicate any thing. The Inspector-General of Prisons was written to the other day for a few particulars of the results of the experimental cultivation in jails, but the information was not supplied and reference was made to the Secretariat. Knowing that Mr. Burgess and his office are just now overwhelmed with work, we have not thought proper to trouble them; but Dr. Kelly might very well have obliged, as neither the welfare of provincial jails, nor that of the country at large, would have been jeopardized by the public being enlightened n the subject.

AGRICULTURAL EXPERIMENTS.

THIS is a great age of experiments. In all branches of knowledge inquiry is stimulated to the utmost. Nature is eagerly questioned and beseeched to unfold her secrets. Her ways and means of working are tested by the scientific experimentalist. Eager to learn, devoted to his work, he wrests from Nature slowly, and one by one, some precious truths that have long laid hidden and unsuspected by man. At first it may appear that the new truth is simply an abstract fact bearing no relationship to any phase of human labour and daily life. But it does not remain long before skilful mind and hand applies it to some practical use for the public good. Whether the discovery be a new light, one of the laws of sound, heat, or motion, it is soon made available for the interests of trade and commerce.

In all departments of art and manufacture there are vigorous, untiring explorers. Agriculture in the present day in particular has a host of devotees. During the last quarter of a century most important work has been done in scientific investigation of the properties of soils, the elements of plant life, and other subjects connected with the pursuit of agriculture. Our chemists have been indefatigable in their researches. They have sometimes erred in their deductions, and have had to submit to correction. For the most part they have worked honestly, their only object being to ascertain the truth and not to bolster up preconceived theories. The ordinary farmer also has acquired a taste for agricultural experiments, and no longer plods his weary way through life with an uninquiring mind as his ancestors did in days gone by. In England, on the Continent, and in America a host of explorers in scientific agriculture are found. The results of their experiments are always interesting, although not unfrequently inexplicable. A large number of experiments made lead to little practical good. This will always be the case, but they should not therefore be discouraged. Out of the multitude of counsel some wisdom may always be obtained. But the various conditions of soil, climate, aspect, character of the seed, and various other disturbing causes render the attainment of absolute scientific truth difficult in agriculture.

Agricultural experimental stations supported or subsidized by Government, common elsewhere, are unknown in England. Agricultural research is left to private individuals or to farmers' clubs, societies, or associations. Mr. J. B. Lawes is the greatest private experimentalist, not only in England, but in the world, and agriculture everywhere is indebted to him for his noble work. Dr. Voelcker, acknowledged by all to be the leading professional agricultural chemist amongst us, has enriched our store of knowledge with the results of years of laborious and original research conducted in the most conscientious and painstaking manner. Other labourers in the same field, less skilful, less original perhaps, have contributed to adorn the literature of agricultural chemistry in recent years. When to the labours of pure scientists we add the combined action of practical agriculturists, the stock of agricultural experiments on hand is large. Those of most importance are the Rothamsted and Woburn experiments. But in various parts of the kingdom investigations on a smaller scale of great interest and value are conducted. In Scotland especially there are several societies that have entered the field of independent inquiry—and with more or less success. But before any definite conclusion can be arrived at in the relation of special manures to special crops, trial must follow trial with a tedious pertinacity of effort. Hurried generalizations on the result of a few experiments only mislead farmers, and hinder the progress of scientific agriculture.

In judging of a single experiment there should always be considered the possibility of experimental error, or the influence of some exceptional unknown causes, especially when the result appears to be at direct variance with general experience. When, for instance, a crop of turnips is lighter where superphosphate is used than where it is not, some suspicion should be aroused, and no hasty conclusions should be made. In one instance we believe

in the Woburn experiments, farmyard manure would appear to be prejudicial rather than otherwise to the produce raised. It certainly could not be injurious judged of as a combination of elementary food substances. It is possible in a dry season that long "strawy" manure may not yield any of its virtues to the growing plants, and may, by its mechanical condition, alter the texture of the soil to its detriment for the time, but none would therefore think of condemning its use. It is only by repetition that we can make sure of eliminating all sources of error. Experiments in turnip growing are especially difficult to deal with. Every farmer knows the great irregularity sometimes found in a field of turnips as the result of ploughing on two different days, or of sowing the seed at different hours of the same day, all other conditions being precisely similar. When there are anomalous results on the same farm even in the same field, what can be expected of trials made at separate places under totally different circumstances? Considerations such as these should warn us against too quickly accepting the apparent teachings of a few experiments only, notwithstanding the care with which they have been conducted. Most important questions to be taken into account in field experiments are the previous condition of the land, the crops grown, the manures used, and the process of cultivation pursued during the five, ten, or more preceding years. It is at this point that the experiments of Mr. Lawes have been hitherto unique and unapproachable. The soil of his experimental plots is positively transparent, so to speak, from the minute details he gives of all its present state and previous conditions. He makes us familiar with its whole history. He explains its capabilities from practical experience, gives its quality and present condition according to analysis, or by an equally convincing process of reasoning from its past, until at last the soil plays him no tricks of disappointment, for he is able to predict almost to a nicety what will follow from the application of any given manure to any given plot. The Woburn experiments, based on a like method of procedure as has been adopted at Rothamsted with such excellent results, will afford an invaluable record of agricultural experiments. It will take some years before any teachings of a definitive character will be elicited, but, when obtained, they will prove of inestimable value. Meanwhile we would encourage agricultural bodies everywhere to make experiments for themselves, and thus add to the common stock of facts in relation to the growth of farm crops.

PRIZE FERTILIZERS.

RESPECTING the important display of fertilizing matters at the Paris Exhibition, what most struck the visitor was the absence of all show to attract clients. Manufacturers remained content to demonstrate that the preparation of artificial manures was not behind any chemical or mechanical industry, that the raw materials of these manures were sought for with intelligence, transformed and combined in a rational manner, with no secrets to conceal, and sold at prices proportioned to intrinsic value. The proofs were conclusive of the great development in the extraction in France of mineral fossils, in Belgium of the refinement of chalk phosphates; of the general preference for dissolved and pulverised guano in place of that fertilised in its crude state. Serious progress was shown to have been made in the torrefaction of animal refuse. However, the treatment of night soil, and its rational utilisation, leaves very much to be desired. It cannot but have also struck the observer how much commerce stood in need of a "common chemical language," for the various preparations which restore to the soil, azote, phosphoric acid, and potash—the three terms in use on the continent to express the value of a fertilizer, while in England, ammonia, phosphates, and the salts of potash, are the expressions employed.

It is only since 1840, when Liebig laid down the imperious law of restitution, that a veritable revolution ensued in the trade and manufacture of commercial manures. In France alone, three milliards of francs represent the annual sum employed in the fabrication, &c., of fertilizers France is also the richest country in the world in fossil phosphate of lime, that employed in agriculture being chiefly derived from the tertiary formation in the form of phosphorite, and as nodules, in the secondary strata; the latter are found in the neighbourhood of Lille, Mans, and in the departments of the Meuse, and Ardennes the former are chiefly obtained in Aveyron, the Lot, Herault, Tarn and Garonne, Beziers, &c. One firm, Desailly, commenced in 1850 to extract nodules in the Ardennes; since then, its operations have extended to other parts of France, so that at present it employs 1,000 workmen, and produces 20,000 tons of phosphate of lime yearly, of which one-third is exported. Some of the phosphates contain from 28 to 33 per cent. of phosphoric acid, and are largely employed in the preparation of superphosphates. The value of the mineral phosphates depends on their mechanical fineness, or pulverisation for the assimilation of a fertilizing matter is more rapid, as the points of contact are more numerous with the dissolving agents of the soil—water, carbonic acid, and organic matter. But there is a limit to the economic action of minerals in the shape of impalpable powder. Thus a ton of triturated feldspar rock, containing 10 per cent. of potash, and costing fr. 66, will be infinitely inferior to the salt easily obtainable in a cheaper and more concentrated state.

No doubt it is very laudable to extract phosphates from the bowels of the earth; to import guano from South America and Australia; nitrate of soda from Chili, and fish guano from Scandanavia. Not less important is the economic utilisation of the detritus of slaughter houses and knacker's yards, and of public markets. In Paris, cesspool matters afford annually 7,000 tons of *poudrette*, and 3,000 tons of ammoniacal salts. At Amiens, fecal matters have charcoal for the base of their *poudrette*, and the chopped refuse of flax and hemp. Velvet clippings, brewer's refuse, straw, wool and leather waste; this mixture, when enriched with assimilative phosphates, sells well. For years the *debris* of slaughter houses has been in much request in France. But industry entered the lists, and by its aid, the utilisation of blood, flesh, horns, hoofs, hair, skins, &c., has become a speciality in France. The firm Bourgeois, for example, contracts for the blood of the chief slaughter houses in this country, amounting to 13 millions of quarts annually, and they employ 260 persons to work it up into marketable products. The blood is dried by three processes; contains 13 per cent. of nitrogen, and is mixed with superphosphates in various proportions. Another Company farms the intestines, &c, of the killed beasts, and when manipulated, this *detritus* is sold in three classes. The average number of animals daily killed in the city *abattoirs* is, 700 oxen, 150 cows, 30 bulls, 400 calves, 6,000 sheep, and 500 pigs. But as horns, hoofs, hair, skins, leather, &c., require two or three years to decompose in the soil, their reduction to a pulverable form is indispensible—hence torrefaction is resorted to. The preparation of bones has many various methods of application, but none particularly new. On the west coast of France, sardine and mackerel refuse, with sea plants, are boiled, after being previously drained, in large boilers; then pressed into cakes while hot, and ultimately dried, and ground. The peculiarity about guano consists in its being rarely employed otherwise than in a dissolved state, thus permitting of a fixed rate of nitrogen, 12 per cent. generally, to be obtained; of late years, much of the Peruvian guano imported had not more than 2 or 3 per cent. of azote, and the farmer was invited to pay a uniform price all the same by the Peruvian Government. France does not manufacture either dissolved or pulverised guano, but supplies her demands from England and Germany. Farmers habituated to employ only farmyard manure, guano, &c, viewed with suspicion the use of chemical manures; the honor of destroying their prejudices under this head, is due to M. Georges Ville, only he rode his hobby to death by prescribing doses of chemical fertilizers, compounded on the data of the ashes of cultivated plants, to restitute the salts carried away, just as if we were certain of the conditions of a soil's fertility. Strange, not a manufacturer prepares artificial manures for the general market on M. Ville's principles. It was only in 1860 that Norway commenced to utilise the refuse of her herring, cod, and mackerel fisheries, &c, having by pressure and steam, succeeded in depriving the refuse of the oil and glue, which proved insurmountable obstacles to the dissolution in the soil of the phosphates and azotised matters. Fish guano is now prepared along sea coasts in every part of the world; on an average it contains six to seven per cent. of organic nitrogen, rendering in this form the action of the manure more slow, certain and generally useful, and 16 per cent. of phosphoric acid, but not in a state immediately soluble; hence the difference between it and ordinary guano, and the practical lesson, that it ought not to be employed as a top dresser, but harrowed into the soil, before the sowings.

BULANDSHAHR AGRICULTURAL SHOW AND HORSE FAIR.

THE following more detailed account of this Show has been forwarded to us by a correspondent:—

The seventh annual Agricultural Show was held at Bulandshahr on February 18th and following days, and was as successful, or even more so, than in the years preceding. The show was first of all started in the year 187[illegible] by Mr. Willock, the then Collector of Bulandshahr, and it owes its origin to a happy idea of his that the cultivation of good varieties of wheat might be stimulated, if zemindars were encouraged to exhibit samples of their produce and subscribe for prizes to be awarded to the most successful producers. There can be no doubt that the rivalry which such exhibitions give rise to is a powerful stimulus to agricultural improvement, sometimes indeed acting when mere self-interest would seem quite inoperative. The opportunities which are given to agriculturists of comparing the results obtained by them with those of their neighbours are of course most useful, since in this way experience is gained far more quickly and easily than is possible by individual and unassisted experiment. Seeing the great improvements which these shows are admitted to have led to in English agriculture, it is worth the consideration of Government whether it would not be advisable to give grants of money prizes for the promotion of agricultural exhibitions in different parts of the country, in the same manner as they are now being given at the various horse fairs recently started. As it is, the Bulandshahr Show is supported entirely by voluntary contributions, and it is a matter of no little credit, both to the official and non-official residents, Native and European, that they have carried out the scheme as originally started by Mr. Willock with yearly increasing success. The Show comprised exhibitions of agricultural stock, implements, and produce, horses and native manufactures. The latter were specially good, as might be expected under the auspices of the present

Collector, Mr. F. S. Growse, C. I. E. Specimens of the more notable native manufactures (Azimgarh pottery, Benares brass work, &c.) were exhibited, and in some cases distributed to persons interested in them; and the attention which has been paid to the subject has already borne noticeable fruit in the district, some articles exhibited by Bulandshahr draftsmen being specially good both in idea and workmanship. The exhibition of agricultural produce was very interesting, forming a collection of nearly all, if not all, of the various products of the district; and in some cases the samples exhibited were of extremely good quality, and showed careful cultivation. It is said that very many of the more intelligent cultivators have begun, far more generally than before, to *select* seed for sowing, setting aside the finest of their produce for this purpose, instead of going on the happy-go-lucky system which is generally followed. The agricultural implements exhibited were not remarkable, and native ideas do not appear to have been able to effect much improvement either in ploughs or water-lifts. It is to be suspected, however, that more good would result were Government to assist with a pecuniary grant, as the prizes could then be awarded with rather more indifference to the feelings of the exhibitors. As it is, most of the chief exhibitors are also contributors to the prize fund as well as judges on one or other of the various committees, and it is only to be expected under these circumstances that occasionally in their awards they are rather more influenced by their regard for the exhibitor than by the quality of his exhibits.

The show of horses was above the average, the occasion of the Show having been taken advantage of by Government to make Bulandshahr one of the district horse fairs, which are now held under the supervision of the Superintendent of Horse Breeding Operations. A good horse, therefore, had a chance of obtaining two prizes · one from the Government grant on the judgment of the committee appointed to award prizes from it, the other from the voluntary contributions of the district, which were distributed by a second committee.

Among the most noticeable things at the Fair were a McComa's water-lift, and an improved American plough, exhibited by the Department of Agriculture and Commerce, both of which were kept working from time to time, and attracted great attention. The high price of the lift, over Rs. 200, will, it is feared, bar its general adoption; but it has been found practicable to adapt the principle it acts on to a construction of wood and rope, which could be made up for a comparatively trifling sum. The plough, which is both light and effective, was much approved of, and numerous applications for ones like it were made. Since it can be constructed by any ordinary intelligent carpenter, Mr. Growse was wisely in favour of getting them made up in the district; but a large number were indented for as samples. A fact which tells for its future introduction is that the cultivator, whose bullocks were hired to draw it, asked for two on his own account.

The new form of sugar-mill, invented by Messrs. Thomson and Mylne, which has been so largely adopted in Shahabad, and a couple of Bull's dredgers were also exhibited, and showed to advantage.

The Show may be regarded as most successful from another aspect, for the pleasure it gave to the crowds of natives, villagers and towns-people, who frequented it. Most of the native gentlemen and proprietors of the district were encamped round the plain on which the Fair was held, and the opportunity afforded them of meeting each other seems to be much appreciated, and is said to have promoted freer and more intimate social intercourse between them than formerly existed. For the crowds of spectators the Show seemed to afford unending amusement, wrestling succeeded exhibitions of conjuring feats, and scratch horse races the wrestling; while illuminations and fireworks brought the last evening of the Fair to a brilliant close. Nothing happened to mar the arrangements, which were excellent throughout, and are most creditable to the district authorities. A special word of praise is due to the Tehsildar, Pundit Hurgyan Singh, to whose unremitting exertions the Show owed much of its success.

The crowds of well-dressed happy looking villagers were a marked feature of the Fair, and had one of our modern pessimists been present, he must have felt how lightly the people of India bear to all appearances their country's "bankruptcy."

THE DATE-PALM OF THE PERSIAN GULF.

READERS of the newspapers must have learned how the date-trade of the Persian Gulf has been increasing of late how the miners of the Black Country have taken to eating dates, how the Arabs themselves almost live on that fruit, and even feed their horses on it, while there are few in this country who do not know the taste of the luscious berry that finds its way to Calcutta in queer-shaped baskets, so different from the woody substance known to the Hindoos as the date. But there are few who are aware that the attempt to grow the Arab date in India has been successfully tried. The experiment originated under the auspices of a Chief Commissioner of Oudh, and the Conservator of Forests in Mysore and Coorg has also been supplied with plants. Some shoots have recently been sent from Busrah for experiment in Rajpootana, where the native date still grows in abundance, and we shall be glad to hear how they have succeeded. Meanwhile a memorandum on the system of cultivating the date-palm in the vicinity of Bushire has been written by Mr. J. C. Edwards, the 2nd Assistant Resident, from which we cull the following details:—

Offshoots which sprout round the foot of the female trees are procured from Busreh Katef or Bahrein, and transplanted to wherever the cultivator may desire to have a date grove. These offshoots may be procured of all sizes, but the smaller ones—say one foot high—are preferred. After being transplanted they require to be watered daily for two or three years. The soil in which they are planted should be soft and the base of the plant surrounded with manure. The manure used is horse dung mixed with earth and allowed to decompose for a year before being used.

Where water is plentiful the offshoots spring up rapidly and bear fruit within four or five years. But where water is scarce and the soil hard, ten or twelve years elapse before any signs of fruit are visible. Opinions differ in regard to the rearing of date trees from seed, but all agree that offshoots are the best, inasmuch as they take less time to grow and are far more strong and productive than the trees reared from seed.

The date tree first shows its blossoms in February, the cultivator has then to decide what number of branches he should leave on the tree and withdraws the superabundance. The number of bunch blossoms on each tree varies from 12 to 24, but it is seldom that more than 12 are allowed to remain for fruit.

At this period also the cultivator has to impregnate the blossoms of the female tree by joining thereto some portion of the blossoms of the male tree. This is done by simply depositing a sprig or two from the male into a bunch of the female blossom and lightly binding it up with a sprig. The male tree is distinguished by its blossom which is of a reddish tinge, while that of the female is milky white. The blossom of the male tree is only used for impregnating, and does not turn into fruit. It is averred that in places where the date palm grows thick together, the wind scatters the pollen of the male blossom, and that the female trees thus become impregnated with it, saving the cultivator further trouble on this head. When through neglect or oversight the female tree fails to be impregnated, it is asserted that the fruit it bears does not come to perfection, is seedless and insipid.

About May the fruit begins to form and from this time to September, when it is perfectly ripe, the tree sheds the superabundance which is used as food. At this period (May) the fruit is known as "Khumal" and is green in colour. In June or July it is known as "Kharek" and is either red or yellow. It is then fit to be eaten. In August it becomes soft and juicy and is known as "Ratab" but is not yet in a fit state for preservation, which it does not attain till September when it is known as "Khurma." It is then taken off the trees and gathered into a tank or trough exposed to the sun where it throws off its extra juice, and hardens sufficiently to allow of its being packed up in baskets and prepared for exportation. The juice is gathered and stored in skins or jars, and is used by the poorer classes in lieu of sugar.

There are more than a hundred varieties of date known by different names which it would not be easy to enumerate or describe, nor would there be much utility in doing so, for they are only understood by the natives of those parts to whom it is a matter of great consequence to know the the name of the date they purchase, as prices are regulated thereby. These latter vary in the ratio of 1 to 4. The best description of fruit is packed in skins of 70 to 120lbs., the average price being 15 krans (about Rs. 6) for the latter weight.

The poor feed on the droppings of the date palm from May to September, and keep the produce as food for the next 7 months, the branches *supply* them with fuel and material *for* hutting, the fruit branches when divested of the fruit are used as brooms, and the leaf turned into rope or matting, the stem is cut up and used in house building. Toddy is not extracted, as this people have not yet acquired a taste for that liquor.

AN ECONOMIC BUREAU.

NOT many months ago we mooted the question of an Economic Bureau for this province, and urged on the consideration of the local administration the advisability of establishing such a department. What we then said was, it should be the *special* duty of the bureau to give attention to the natural productions of the country as well as attend to the development and conservation of local industries. To-day the reasons are stronger than ever, and as the country advances these will be getting stronger and stronger. They have a public department in India for the purpose, but Imperial necessities are so many, large and various, that local wants as a rule do not receive that care and attention they deserve. Certain it is the wants of British Burma in this direction, have not been attended to as they require. The country is, comparatively speaking, new, its natural resources "legion," and what it needs is a special department, for the initiation and carrying out of measures that will develop these rich natural resources. There is a wealth of oil, wood, resin, minerals, in the country, of which the world in particular, and even persons living in it generally, know little. The other day only the olive was found growing wild in Tharawaddy; and so luxurious is its growth, that an Italian gentleman gave it as his opinion that the growth of olives in British Burma would open out a most remunerative field for speculation. While it takes fifteen years to arrive at perfection in Italy, the olive plants here are so forward that in five years they yield as much as plants elsewhere of fifteen years' growth. Then there is lac, and the narrative of attempts to establish its manufacture goes further than anything else to show the great need there is of a department such as is urged. Those who are familiar with the subject, will acknowledge the truth of this remark. Up to 1873, although lac was well known by the *people* to exist in the country, and although the manufacture of it was widely practised, none of our officers seemed to be aware of these facts, for when the question of the establishment of its manufacture was first agitated, other countries were asked not *only* for instructions how to treat the insects, but for the *insects themselves.* Yet all these years,

on the bushes and branches of some dozen varieties of shrubs and trees the insects might have been found all over the country in every district, even on the Arakan Hills. This is what Colonel Twynam says in a letter addressed to the Conservator of Forests some time back :—

The Chief Commissioner has read Mr. Strettel's paper with much interest. It has now been ascertained that the *Coccus Lacca* (The lac insect, ED. *W. R.*,) is to be found in nearly every district in Burma, including the Arakan Hills, from which a very fine specimen has been received, and valued by a leading firm here at Rs. 130 per 100 viss.

The matter is alluded to here not for the purpose of reflecting in an adverse way on any department, but just by way of establishing our contention regarding the necessity for a special department to attend to natural resources. Existing departments are too much burdened with work, and to expect any, even the Forest, to take up this additional work would simply be to expect what would never be attained. But from the above it will be seen that while there existed quite a wealth of one resource at home, no body, we are aware of, ever said anything about it, and the local administration in its ignorance sent across the seas for intelligence and material that was available at its very doors. A better illustration of darkness under the lamp would be hard to quote.

The same with regard to silk. The tussur moth exists here, as well as the ordinary silk, yet how little is done for that industry may be seen from the quantity of indigenous raw silk, annually exported. So also with gold. It abounds in the Malayan Peninsula, particularly in the Shwegyeen district and to the north of it, yet how little is ever taken to the market. So with coal, now stated positively to exist in the Ramree district.

It would be easy to fill columns of this paper with particulars of local resources and industries neglected and languishing, needing only a little enterprize to enrich the country and the speculator engaging in them. What is needed is that a knowledge of natural resources be disseminated far and wide in order to attract capitalists. And to do this effectually an Economic Bureau must be established. The Phayre Museum might very well be developed into one. An officer who understands these matters, and who will enter heart and soul into the work, ought to be entrusted with it. The present Secretary to the Agricultural and Horticultural Society is just the one to be placed in charge of such an institution. Intimately acquainted with the country and its productions, his large and varied experience extending over a number of years point him out as the very person to be entrusted with the care of such a charge. It need not be very large, nor need the initial and subsequent expenditure be great. A sufficient outlay from Provincial Funds will be needed in the beginning, and afterwards a small establishment will have to be entertained. The collections from visitors would go in some measure to lighten the cost of monthly expenditure and the produce of the garden would add to that. Mr. Aitchison will confer a boon on the province by the establishment of such a department, and we earnestly commend the matter to his consideration.

After writing the above we were shown a piece of pine wood, obtained by the late Mr. Nepean, from the forests in the vicinity of which he so lately lost a life that was abundantly fruitful in good work to a Government that did not appreciate him as he should have been appreciated. The existence of this pine, named by Dr King the *Pinus Merkusi*, was not known of till Mr. Nepean got it. It is so rich in resin that its growth would pay remarkably well, and if we allude to it here it is only to strengthen our contention for an Economic Bureau.—*Rangoon Paper.*

CINNAMON.

THE spice trade of India is not only a small one, but one that fluctuates a great deal. The exports consist of such as *cassia, pepper, ginger, cardamoms, chillies*, &c.; and the imports are principally *cloves*. Cassia is closely allied to cinnamon, and the trees of both, as well as their spicy products, greatly resemble each other. Cassia is also known as *bastard cinnamon*. India is capable to producing both plants, and a group of cinnamon trees is one of the pleasantest sights in the tropics. Except in Ceylon, the cinnamon plant is, however, rare in India, and its plantations when got up are attended to with much care. When the plants attain maturity, they acquire a commercial value; but they seldom grow beyond thirty or thirty-five feet in height. In form they are symmetrical, their trunk is smooth and the foliage dense. The leaves possess a fine polish, and are prettily and regularly veined. The tender leaves show a reddish color which time changes into a green hue. A plant putting forth young leaves looks at a distance like a huge bouquet of bluish-green, sprinkled over with pink. Its inflorescence is ordinary, the individual flowers being small, poor of color and inodorous. One would fancy that a cinnamon plant would be fragrant throughout; this, however, is not the case, and a whole plantation may be traversed without a breadth of spicy odour being perceptible. Bishop Heber is said to have declared :—

"After hearing so much about the spicy gales of Ceylon, I was much disappointed at not being able to discover any scent, at least from the plants, in passing through the cinnamon gardens."

On being bruized in any part, however, a distinct odour of cinnamon becomes apparent, and both bark and leaves taste decidedly of the spice. During the cinnamon season, which comes on after the departure of the rains, the gardens are quite odorous; for at such time the young twigs are cut off the parent stem, and the processes of barking, peeling, rolling the brown sticks proceed in all directions.

The cultivation of cinnamon is neither difficult nor laborious. All that is necessary to success is a hot, damp atmosphere, and a sandy soil, rich in decayed vegetable mould. Shade also is necessary. A locality satisfying all these particulars needs nothing more than to have the plants put down at convenient distances, and attention to such ordinary matters as occasionally stirring the soil near the roots and keeping the space round them clear of weeds. In six or seven years the bushes attain a height of six or seven feet; but no barking is done at such an age. The operation usually commences when the trees have attained a growth of some years, and it is one of the simplest of processes on the face of the earth. The young twigs, not *very* young, are first slit in a longitudinal direction, and next transversely, the bark is then loosened from the tender wood, peeled, scraped, sorted, packed, rolled, dried and put into bags of 80 or 90lbs. each as the cinnamon of commerce. A similar process is carried on with cassia bark. Cinnamon peeling begins in Ceylon at the close of the rains and lasts till November. The work is attended to by a particular caste of natives who are known as *Chulliahs*, and of them men, women, and children in scores, if not in hundreds, engage in the cinnamon gardens of Colombo.

The best "sticks" are from Ceylon; but Java, Sumatra and Cochin-China amongst others, produce the tree plentifully. The best Indian variety is that from the Malabar Coast; but the tree can be grown almost anywhere at no great distance from the sea-coast, provided the requisites of shade, drainage, a hot, damp atmosphere and rich soil are present. Such being the case it is possible British Burmâ possesses localities that would be favorable for the growth of the tree, and cinnamon as well as cassia introduced here. Young plants of both kinds might be put down in forest clearings in the best sities procurable. The preparation of the yellow pipes would not be difficult once success is attained in the matter of growing in the trees: the work would just suit the native population. Moulmein promises a better field for experiments in this direction. There the mangosteen and cocao grow, as well as varieties of the natural order *Myrtaceæ*. A few experiments with cassia and cinnamon might be tried without much expense or risk, for the prospect of gain is not inconsiderable if success be attained. The quantity of spice imported into Great Britain averages annually 850,000lbs. British Burma might be able to contribute somewhat to this annual average.

NEW COMMERCIAL PLANTS.

UNDER the above title, Mr. Thomas Christy, of 155, Fenchurch-street, has issued another of his pamphlets, which treats of products either quite new to commerce, or of those that have been for some time known but have not come into general use. These pamphlets demonstrate at once the truth that the world does yet contain a vast field of unappropriated wealth, and it is only by constant watchfulness, or a keen perception of what is really valuable, that the fine metal is separated from the dross, so to speak, and new commercial products are established in our markets. The discovery of new rubber-yielding plants, and the extended geographical range of well known species, are matters that have often been referred to in those pages, and in the pamphlet under consideration a new rubber plant is described, and figured under the name of *Urostigma bogelii*. Referring to this class of plants, Mr. Christy says, in his preface. A great many plants yielding india-rubber are now known to botanists, and more are being discovered every year. Comparatively few, however, are fit for general cultivation; some which yield excellent rubber do not produce an adequate return until after many years, others require certain peculiarities of soil and climate for their successful culture; while others, again, which possess the advantages of rapidly coming to maturity, and of being easily cultivated, yield a rubber of low commercial value."

There are, perhaps, few questions in economic botany regarding substances of such great commercial importance as india-rubber, where the plants producing them are involved in such mystery. It is to be hoped that by the energy of collectors abroad, supported by such men at home as the author of the pamphlet in question, a true knowledge may soon be obtained of these botanically and geographically widely diffused plants.

Mr. Christy draws special attention to the *Gynocordia odorata*, or the tree yielding the Chaulmugra oil, as one of the most important plants for introduction into all tropical countries, on account of the great therapeutic value of the oil obtained from the seeds. This oil has long been known, and valued highly in "India and China as a remedy for skin diseases and other complaints due to impurity of the blood, and as a specific for secondary syphilis. . . . . In the Mauritius it is considered to be the only reliable remedy for leprosy, and so high a value is put on its purity that the seeds are imported from India for the purpose of obtaining the oil free from adulteration. . . . .

The pure oil in India is expensive, and therefore offers a great inducement to the natives to adulterate it; indeed, adulteration is carried to such an extent, and is so difficult to detect, that it has occasionally caused medical men in India to discontinue its use. Preference should, therefore, be given, in purchasing the oil, to

that which has been expressed from the seed in this country." It is chiefly in the cure of consumption that this oil is now used, and is strongly recommended by many medical men of note. Among the public institutions where it is now in use may be mentioned St. Peter's Hospital, Berners-street, the Margate Infirmary, the Hospital for Diseases of the Chest, City-road, St. John's Hospital, Leicester-square, &c. From the satisfactory effect of this oil in many reported cases it seems that its general adoption is insured, as in India a good deal, nay, nearly all depends upon the purity of the oil supplied, and complete purity is guaranteed in the oil furnished by Mr. Christy.

Another plant of India which deserves more attention in this country than has hitherto been accorded to it is the Maliwall (*Bassia latifolia*), which is very abundant in all parts of India, both in a wild and cultivated state. The most valuable product of the tree is the flowers, which are produced in enormous quantities and fall to the ground so thickly when fully ripe as to form a dense carpet. These flowers are gathered each morning, and stored by the natives for winter use. They contain a large quantity of sugar, and a strong spirit is distilled from them, very similar in flavour to Irish whisky; this spirit has been proved upon analysis to be very wholesome, and when carefully rectified can be obtained exceedingly pure.

Such then are some of the products of the vegetable kingdom new to commerce in this country, the introduction of which are due to the energy dispayed by Mr. Christy.

THE PAPAW.

At a recent meeting of the Berlin Natural History Society Herr Wittmach, gave an account of some researches and experiments he had undertaken upon this subject, which are thus summarised in a recent number of the *Pharmaceutical Journal.*

"A perfectly ripe undamaged papaw fruit measures from 7 to 8 inches in length, and 3 to 4 inches in width, and has the appearance of a rather long melon; it has a beautiful yellow rind, which in its taste also resembles the lemon, though with a slight flavour of turpentine. The most interesting and important property attributed to it, however, is the power of its juice to rapidly render hard flesh tender.

"As far back as the year 1750, Griffith Hughes says, in his *History of Barbadoes*, 'This juice is of so penetrating a nature that if the unripe peeled fruit be boiled with the toughest old salt meat, it quickly makes it soft and tender, and if pigs be fed with the fruit, especially unripe, the thin mucous matter which coats the inside of the intestines is attacked, and if the food be not changed, is completely destroyed.' According to Browne, meat becomes tender after being washed with water to which the juice of C. papaya has been added, and if left in such water ten minutes it will fall from the spit while roasting, or separate into shreds while boiling. According to Holden the flesh of an animal hung to a branch of the tree is rendered tender. Kalston says that in Quito the use of Carica juice when boiling meat is very general, but in Venezuela and Costa Rica the practice is unknown. Some further experiments were made by Roy, who obtained by making incisions in a single fruit 28 39 c.c. of the milky juice, which after evaporating to dryness and again diluting with water, had a powerful action upon flesh, albumen and gluten, while starch remained unaltered by it.

"Herr Wittmach, the author of the present paper, obtained after repeated incisions of a half ripe fruit only 1·195 grain of white milky juice of the consistence of cream. This dried in a watch-glass to a hard vitreous white mass, having what appeared to be greasy spots on the surface, but what really were flocks of gelatinous substance, that always adhered to the more hardened material. The odour and flavour of the fresh juice recalled that of petroleum or of vulcanised India-rubber. The microscope showed it to be a fine gummous mass containing some larger particles and isolated starch grains. Iodine coloured the juice yellowish brown.

"A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grames of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments made without the juice the boiled meat was visibly harder. Hard-boiled albumen, digested with a little juice at a temperature of 20°c., could after twenty-four hours be easily broken up with a glass rod. Fifty grains of beef in one piece, enveloped in a leaf of C. papaya during twenty-four hours at 15°c., after a short boiling became perfectly tender; a similar piece wrapped in paper and heated in the same manner, remained quite hard. Some comparative experiments were also made with pepsine, and the following are the conclusions arrived at by the author:—

"1. The milky juice of the Carica papaya is (or contains) a ferment which has an extraordinarily energetic action upon nitrogenous substances, and like pepsine curdles milk.

"2. The juice differs from pepsine in being active without the addition of free acid—probably it contains a small quantity; and further it operates at a higher temperature (about 60° to 65°c.) and in a shorter time (five minutes at most.)

3. "The filtered juice differs chemically from pepsine, in that it gives no precipitate on boiling, and further that it is precipitated by mercuric chloride, iodine, and all the mineral acids.

4. "It resembles pepsine in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron."

MANURE.

When manure is "fire-fanged," or overheated, the most valuable portion—the nitrogen—is driven off, although the mineral elements remain. To prevent overheating, it is not required to continually fork over the manure, but simply to compact the surface of the heap, and to cover it with a thin layer of earth. Unbleached ashes may be mixed with bonemeal, if care is taken to cover the mixture with plaster, or earth; and the action of the ashes will act upon the bones to reduce them to plant-food but, unless the earth or plaster is used, there will be a great waste of nitrogen from the bones. There is no climate in the world where manure requires more looking after to get any good from it than this, and yet of all places it is here allowed to lie exposed to the elements, to be bleached and washed clean of all its fertilising properties. There is more labour necessary to "lead manure" on the land for cultivation than will pay for this wanton and foolish waste. Manure, such as cow-droppings or goat manure, becomes almost useless if spread for any time on the surface of the ground, exposed to the sun and the rain, and yet at the present time, if our horticulturists or agriculturists wish to enrich their lands, they must either get a supply of this rubbish or pay heavily for a manufactured article, such as animal manure or superphosphate of lime and other artificial preparations. To utilize the cleanings of stockyards, measures must be taken to conserve the volatile and free elements of the manure, and the best means available for this is either a boxed-up space made with slabs above the surface of the ground, or a pit sunk in the ground, which, of the two, is preferable. Whichever plan is adopted, let it be remembered that manure to have a chance to do its best should be always moist enough to allow fermentation to take place uninterruptedly, and to prevent the dry burnings such gatherings are subject to. All experienced men are aware that these dry heats are utterly destructive to the best fertilizing qualities of the manure heap, and hence to prevent this on all high cultivated farms much labour is expended in frequent turning of the manure to check this. Whatever may be thought about this, or whatever neglect may be suffered under present circumstances, the time will come when cultivators will know that they must manure if they would reap, and this manure must be looked after to get any good from it. While manure heaps require to be moist they must not be where they would lose their soluble particles with floodings. A pit may easily be secured by using the earth taken from the excavation to form an embankment all round it, and the raised enclosure can also be protected by digging a trench round it to carry away surface water. In addition to these necessary precautions to save the volatile or perishable particles of the manure before it is used, it is equally necessary to take care that there is no more waste than is possible when applying it. As a rule manure should never be allowed to be for any length of time exposed on the surface of the soil without covering. When covered with soil, which is a powerful deodorizer, the waste is reduced to a minimum; and in any case manure should only be carted on the land when wanted for a crop about to go in or already in. There are many experienced cultivators who prefer to cart manure on land when crops are up, and then to cover it with the horse hoe or cultivator, or even in some instances they harrow it in—*The Inquirer.*

CARBON AS PLANT FOOD.

The great mass of vegetable matter is composed of woody fibre (cellulose), which consists of carbon 44 per cent., oxygen 49 62 per cent, and hydrogen 6 38 per cent. Nearly one-half of the vegetable growth of our forests and fields is, therefore, organised carbon. This substance is known to us in the form of charcoal, though the diamond is pure crystallized carbon. In its uncombined form, it is not soluble in any known liquid, nor is it fusible in any heat we have been able to produce. At red heat, it combines readily with oxygen in a brisk combustion, without flame, and the product is a gas composed at 27 per cent. of carbon and 73 per cent of oxygen, and commonly known as carbonic acid. It has a feeble acid reaction, and forms salts with alkalies. At the temperature of 60 degrees, water will dissolve and hold in solution its own measure of carbonic acid gas; but it parts with it all at a boiling heat. In this form all the carbon appropriated by plants is furnished, and it would be a very natural inference that to

furnish a supply of carbonic acid would be the first care of the farmer. But this would be altogether an erroneous conclusion.

From various sources, the air is always supplied with carbonic acid in sufficient quantities to answer the demands of plant growth; but the chief interest of the farmer is to place his crops in a favourable condition to appropriate the carbon brought within its reach. An animated dispute has been carried on for several years between two schools of vegetable physiologists—the one contending that all the carbonic acid used by the plant was absorbed by the leaves; and the other holding that a portion of it was supplied by the roots, being held in solution in the water absorbed. The question, however, is one of but little practical importance, as both parties admit that plants derive all their carbon from carbonic acid, and that the decomposition of that gas takes place in the leaf.

The important matter, practically, is to understand the conditions under which vegetables appropriate carbonic acid; for this is the secret of their growth. These conditions are chiefly two: first a healthy condition of the leaf; second, a full exposure to sunlight. The first of these is that which chiefly concerns us. Leaves absorb carbonic acid in proportion to the amount of green colouring matter they contain. This, as I have always said, depends on a supply of nitrogen in a form that the plant can use it.

Ammonia dissolved in water and absorbed by the roots is the usual form in which the supply of nitrogen is obtained. This is decomposed in the leaf by the agency of sunlight, and the nitrogen, set free, immediately enters into a new combination, and the green colouring matter is the result. But this change demands the presence of potash and phosphoric acid, in very minute quantities, indeed, but still essential. A deficiency in any one of these conditions will give a pale or yellow leaf, and every farmer knows what that means, though he may not be able to explain why it is so. But plants absorb no food, by the leaf, in the dark, and there is no chemical action in the absence of sunlight. It is true that plants grow at night, but they grow by using the material prepared in the light and by its agency.—R. T. Brown, in the *Country Gentleman's Magazine.*

THE GEOLOGICAL SURVEY OF INDIA.

THE following Government Resolution has been sent to us —The year under report was comparatively unproductive of fresh work. Mr. Lydekker continued his explorations in Kashmir, but in consequence of the famine there, and of a temporary indisposition, he was prevented from carrying out his projected visit to the Gilgit region, and was obliged to content himself with making an examination of the sedimentary rocks of the mountains of Dras and Tilail. Mr. Hacket also again carried on his investigations in the Aravalli Range in Rajputana. Mr. Fedden and Mr. Foote broke new ground during the season, the former in Kattywar, where a large extent of country was surveyed, and the latter to the south of Trichinopoly. Mr King was employed in working out the connection of the formations mapped by him in the Lower Godavery district with those mapped by Mr. Hughes on the Pranhita; and Dr. Feistmantel visited the Satpura coal-basin with a view to examining on the ground some good sections of the Gondwana series. In the Punjab, Mr. Wynne made a preliminary examination of some new ground in Hazara, having been prevented by difficulties on the frontier from following the formations of the Salt Range across the Indus into the Bannu district, as had been proposed, while Mr. Theobald added largely to the collections of the Sewalik fossils in the Geological Museum.

2. In Palamow, two new coal-fields were traced out by Mr. Ball in the basin of the Koel river; but the coal of these areas is said to be not so good as that of the Daltonganj field lower down the Koel. In December 1877, Mr. Mallet was deputed to report on some coal seams in Ramri Island, which had been brought to notice by the Commissioner of Akyab; but an examination of them did not lead him to form a favourable opinion of their practical value the coal is said to be inferior to that found in Bengal, whilst the measures are greatly disturbed and difficult to work.

3. Mr. Medlicott himself was chiefly occupied in directing the work of the survey, and in editing its publications. In February 1878, however, he formed one of the Committee which had been appointed to investigate and report on the causes of the deterioration of land by *reh* in the Aligarh district; and while in the neighbourhood, he took the opportunity of examining two cases of the supposed discovery of coal in the Sewaliks of Dehra and Nahun, with the result that the reports which had been made were proved to be fallacious.

4. Mr. Blanford's time was fully taken up in the work of compiling the "Manual of the Geology of India," the preparation of which was directed at the close of 18.4, and which the Government of India are glad to learn has at length been completed. The object of the Manual is to place before the general public in an intelligent and popular form the results which have been attained by the Geological Survey of India; and imperfect as a preliminary work of this nature must necessarily be, it will supply what has long been felt to be a great want, and will, moreover, serve as a nucleus from which, in course of time, the survey will be able to develop a more complete record of its scientific labours and discoveries.

5. Owing to the circumstances explained at page 12 of the Report, only one number of the *Memoirs* was published during the year; the *Records*, on the other hand, were fuller of matter than usual: they extended to three times the size originally contemplated, and contained numerous outline maps. Two large parts of the *Palæontologia Indica* were also issued, one on the flora of the Jubbulpore group by Dr. Fetismantel, and the other on the crania of fossil ruminants by Mr. Lydekker.

ENGLISH FRUIT TREES IN MANIPUR.

THE Political Agent of Manipur in his Administration Report for 1877-78, says:—

During the last cold season I have introduced the following English fruit trees, &c., with a view to acclimatizing them in Manipur, *viz.*, apple, pear, plum, peach, apricot, Himalayan apricot, cherry, currant, quince, vine, raspberry, Spanish chesnut also deodars and three kinds of Himalayan pine.

With a view to giving them a thorough trial, I have planted the above in two gardens, one in the valley at a height of 2,570 feet above the sea, and the other in the hills at 5,250 feet above the sea.

Notwithstanding the difference in temperature and rainfall many of the young plants seem to do equally well in both places; this applies especially to apples, plums, apricots, and pears, though owing to the more stimulating climate, those in the valley have grown much more quickly than the others. The Spanish chesnut however seems to prefer the cooler climate, and while those in the hills are doing well, the one planted in the valley is languishing. Cherries I have only tried in the hill garden, and of five trees none are really flourishing, though at first they promised to do better than any others. I intend trying some in the valley next year. The quince flourishes in the valley and so does the vine, while the currants, raspberries, and rhubarb are doing admirably in the hill garden. The deodars and pines evidently prefer the cooler climate of the hills and there, if the winds allow them, will do well, but those in the valley are at present very little inferior in appearance.

It is much to be regretted that the experiment of introducing English fruit trees was not tried long ago, as any time since the opening of the railway to the north-west it would have been easy to procure them, and had a commencement been made ten years ago Manipur might now be producing really fine fruits.

There is every reason to believe that apples will eventually succeed well, as a species of wild apple, far from despicable for cooking purposes, grows well in both the hills and valley of Manipur. For the same reason it is to be hoped that apricots and plums will do well, as an uncultivated kind of both these fruits grows and produces luxuriantly in the valley. I believe that the existence of the apricot in Manipur has never before been noticed by any one; it is rather strange that it should be found here as it is unknown elsewhere nearer than the Himalayas; it seems therefore probable that it was brought in former ages from China, when intercourse between that country and Manipur was frequent. The raspberry of Manipur grows in both hills and valley, and is of three kinds, *viz.*, yellow, red, and black. Dr. Brown mentions the existence of the blackberry, but I have never seen it, and think that he must have mistaken the black raspberry for it.

EXPERIMENTAL FARMING IN MYSORE.

THE Secretary of State for India a short time back called for information relative to the steps that had been taken in parts of India to impart to the agricultural classes generally the lessons to be learnt from model or experimental farms. With reference to this, the Chief Commissioner writes that in Mysore "no general steps have hitherto been taken in the direction indicated, the condition of the province during the past two or three years having forbidden any such measures. Mr. Harman, the Superintendent of the Bangalore Farm, has recently been authorized to make tours in the province twice in the year, once in the summer when the *ragi* crops are being sown, and again during the winter months when crops are being reaped, in view to his acquiring practical experience in the native systems of agriculture, and imparting to the ryots by personal communication and by experiments the benefits of deep ploughing, as also the advantages to be gained by the use of improved seed."

The Chief Commissioner has also under consideration a scheme for placing one or two plots of land in each district under the charge of a village patel or other suitable person, who would cultivate the land in accordance with instructions from Mr. Harman. 'By this means,' the Chief Commissioner observes, 'it is hoped that the ryots will have an opportunity, which the location of the Government Farm at Bangalore does not afford them of judging of the results to be obtained by a better system of farming.' Since these remarks were written, however, it has been decided to abolish the Bangalore Farm, and to transfer the services of Mr. Harman to the Bombay Presidency." Mr. Harman is now out in the coffee districts with a view to enquiring and reporting upon the coffee leaf disease. We trust the local Government will be able to see its way to retaining his valuable services in the province.

SUGARCANE AT BELLARY.

A CORRESPONDENT from Bellary writes to a contemporary :— In many parts the crop of rice has been fully gathered in, and the only standing crop now is sugarcane, which is very extensively cultivated on land lying under the different channels. In every village one passes by, or through, just now, he sees either the mills at work or being constructed, boiling houses erected—very temporary ones, of course,—and boiling going on. The work not only goes on "from morn to dewy eve," but far into the night, and is again begun in " the wee sma' hours ayont the twall." Each member of the "united," though not always happy, "family" taking his share or round of duty.

The mill is a very premature piece of mechanism. It consists of a pit and a foot-board firmly fixed in the pit with two upright wooden pillars cut near the top into a male and female screw. One pillar is stationary and the other is worked with the usual lever by bullocks. The top of the pillars are secured by a collar piece securely fixed on upright, bedded deep in the ground. The stalks of cane are inserted in the female screw upon which when the mill revolves is entered by the thread of the male screw, and so the juice pressed out. The lever pole is very long, and the rear end being heavily weighted the pillar forms the fulcrum. The mill is worked or turned by four, six, or eight bullocks. The refuse of the cane is stored up for manure, as also the ashes from the furnaces, where the boiling is carried out. The leaves prove good and fattening fodder for the cattle.

The produce is from very coarse jaggery to fairly good sugar, according to the degree of attention paid in the manufacture, some never attempting to refine at all, but disposing of it in its roughest condition, packed up in bags made of date leaves, for which there is a great demand at present. The boiling is carried on, "as aforesaid," in temporary sheds, in iron pans from 8 to 12 feet over and from 1 to 1½ foot deep. These cost from sixteen to thirty rupees each, and do not last very long.

The sugarcane growth and sugar manufacture is not confined to land lying under the channels, but is largely cultivated on land under the tanks, especially in the valleys where the soil is good and the percolation from the hills very free. There is now such a briskness displayed by the agricultural classes that a stranger would never believe that the district had but a few months since escaped from the throes of a famine. This sugar manufacture will keep the people employed until the next sowing season commences about April next. Meanwhile the channels will be clear from silt, and the various masonry works repaired.

THE FIRST EMPLOYMENT OF GUANO.

IN an interesting paper on this subject which has recently appeared from the pen of Professor Kohl, the author takes occasion to point out that the employment of guano in agricultural operations is by no means of such modern origin as many of us are disposed to believe. So long ago as the twelfth century the Arabian geographer Edresi called attention to the existence of cliffs covered with the excrement of birds in the Persian Gulf, not far from the famous pearl fisheries of the Bahrein Island, and relates how this dung was collected and despatched to Bassora and up the Euphrates to be used as manure for the orchards, vineyards, and date-groves on its banks. So, too, from the earliest ages the semi-civilized Peruvians made use of the deposits of guano on their coasts for the improvement of their husbandry, and so well was its value in this respect recognized that their white Incas decreed severe punishment for any one killing the birds that produced it. According to our author it was Humboldt who first drew the attention of Europe to the rich deposits of the Chincha Islands in the early part of the present century, but his voice remained long unheeded. It was not until the year 1840 that a ship-load of guano was despatched from Peru to England at the risk of the enterprising firm of Quiros, Allick and Co., of Lima. Experiments were instituted as to its effects on wheat, potatoes, and oat crops, on fruit trees and on flowers, with such wonderfully favourable results that a general demand for the new manure soon arose in England, France, Belgium, and Germany. Hundreds of ships set sail for the Chinchas in search of cargoes of guano, and for many years the Peruvian Government derived an annual income of 16,000,000 dollars from its sale. The depth of the deposits was in many places a hundred feet, and their total value was estimated at £42,000,000 sterling. But even this was at last exhausted, and then commenced the quest for fresh supplies. England first discovered them on the Lobos Islands, and on several parts of the South American coasts as far down as Patagonia, as also on the South African island of Schaboe. The dread of an exhaustion of the known supplies was so great that formally organized expeditions to all parts of the world were undertaken in search of further deposits. The Red Sea itself was ransacked, and a Russian merchant, established at Archangel, sent out an expedition to the Polar Sea, and overhauled the Island of Kolgujew, and the peninsula Kadin. Meanwhile the island groups of the South Sea were diligently searched both by British and American. In the *Journal* of the New York Geographical Society, for 1859, it recorded that up to that time no less than forty-nine islands and groups of islands rich in guano deposits has been discovered by American explorers, and their latitude and longitude accurately determined, and some of these that till then had been uninhabited since the day of their creation were suddenly developed into densely populated centres of untiring industry. In our own Continent, too, the search was diligently prosecuted, and rewarded by the discovery of rich deposits of bones coprolites, and bats' guano, all of high manurial value.

VALUE OF WOOD ASHES AS MANURE.

THE experiments carried on with bleached wood ashes in America continue to be favourably reported on, and to win more friends every year. They have been used for many years by the farmers and market gardeners of Long Island, and later by the same classes in the sea-coast towns of Connecticut, and also on the tobacco farms further inland. Bleached ashes contain considerable quantities of potash and phosphoric acid, which have a wonderfully invigorating influence upon exhausted soils. The onion-growers make large use of ashes, buying them sometimes by the thousand bushels. Fruit-growers are much pleased with its effect upon the growth of trees and shrubs, and upon their productiveness. Their effect is said to be immediately visible in old pastures and meadows, sown broadcast as a top-dressing ; but they act still more satisfactorily if applied to the crops at the time of seeding down. They not only largely increase the crop with which the grass seed is sown, but their influence is visible for many years afterwards in the increased yield of grass. A farmer who has used ashes freely for twenty years upon a hard, worn-out gravel soil says they will give an increase of hay upon a meadow newly stocked for eight years ; and then, if the field be ploughed again, they will show the effect of the ashes for six years longer. He applies about 100 bushels to the acre, on land that he designs to keep in permanent meadow, and about 75 bushels to pasture land. It is particularly satisfactory as an application to a rye crop, even in so small quantities as 20 bushels to the acre. He has reclaimed a large breadth of old fields given up to the growth of bushes, briers, and brakes, and made it a fine pasture by taking rye crop manured with ashes.—*The Journal of Forestry and Estates Management.*

CHLORIDE OF LIME AS AN INSECTICIDE.

THE virtues as a disinfectant of that impure mixture of hypochloride of lime and chloride of calcium, met with in commerce as chloride of lime, are probably known in every household, but its value in gardening operations, or in agricultural work on a larger scale, as a destroyer of vermin, meets with less general recognition. In calling attention to this subject, our contemporary, *Le Cultivateur*, remarks that if a little of this salt be spread on the soil, rats and mice and insects will at once desert it. By its means plants may easily be protected from insect plagues by simply brushing over their stems with a solution of it. It has often been noticed that a patch of land which has been treated in this way remains religiously respected by grubs, while the unprotected beds round about are literally devastated. Fruit trees may be guarded from the attacks of grubs by attaching to their trunks pieces of tow smeared with a mixture of chloride of lime and hog's lard, and ants and grubs already in possession will rapidly vacate their position. Butterflies again will avoid all plants whose leaves have been sprinkled over with lime water.

GARDEN.

MR. JAMIESON, Superintendent of the Government Botanical Gardens, Ootacamund, reports that the case of strawberry plants imported by Mr. H. B. Grigg, C. S., from Australia were quite dead on arrival at the Neilgherry Hills. Each plant was examined carefully, but not one had the slightest vestige of life left, being all completely rotten. Mr. Jamieson regrets the entire loss of what would have been a valuable importation, especially as the plants had been packed with the utmost care and at considerable expense. He suggests that a collection of Nilgiri orchids would be much valued in Australia ; with the permission of Government he will be glad to make up a case of the rarer varieties to be forwarded to Sir William McArthur in consideration of the trouble and expense incurred in packing and forwarding the strawberry plants.

SALICYLIC ACID TO PRESERVE FRUIT.—There appears to be no end to the long list of valuable properties with which salicylic acid is to be credited. It cures nearly all the ills that men and live stock are heirs to, as well as many that they acquire, and it enables milk and cream to set time and temperature at defiance. The latest testimonials in its favour relate to its power of preserving fruit

The process as described by M. A. dal Piaz, of Klosternenburg, near Vienna, is extremely simple, and consists in laying the fruit in jars of syrup containing a small percentage of the acid. The proportions recommended are 2 or 3 grammes of salicylic acid and 100 to 500 grammes of sugar to a litre of water. No boiling or cooking of any kind is required. Berries and stone-fruit of all sorts thus treated will keep good for months together, or even years, without the slightest approach to fermentation, even when the vessels containing them are but insecurely covered, and will preserve their natural aroma unaltered. Boiled fruit-juices will keep equally well with the addition of one gramme of the acid to every 2 lbs. of the juice, and with such addition the colour of the latter is altered in the cooking. The only precaution needed is to secure pure crystallised acid of the finest kind, for the inferior varieties impart an unpleasant flavour to the fruit.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The Annual General Meeting was held on Thursday, the 27th February 1879.

THE HON'BLE LOUIS S. JACKSON, C.I.E.,
President, in the Chair.

THE proceedings of the last meeting were read and confirmed.

The Report from the Council was read and adopted. The Report enters first into the internal economy of the Society, shewing that after deducting for deaths, resignations, and departures from the country, and allowing for elections during 1878, the total real number on the books is 690, which includes Honorary, Associate, Corresponding, and Life Members. The financial position is much the same as in 1877. The best acknowledgments of the Society are due to his Honor the Lieutenant-Governor for the continuance of the monthly grant of Rs. 200 for another three years. The Report then proceeds as follows :—

"Among the members who have been removed by death during the year, Mr. Francis Halsey of Sujanpore in the Punjab, deserves special mention. He died of typhoid fever in August last at Venice on his way to England. Connected with the Society for 15 years, he had been in frequent communication on a variety of useful subjects, some of which are rec[illegible]d in the Proceedings. During more recent years he had turned his attention specially to silk and sugar cultivation in the Punjab, which promised to result favourably. Shortly before his departure from India, he took an active part in the exhibition of silk cocoons held at Nurpur in the Kan[illegible]ra district, and furnished the Government with a report thereon of considerable interest. The Society, many years ago, encouraged this industry when quite in its infancy and awarded a medal to a native zemindar in the Punjab, who had taken much interest in its promotion. 'No unofficial gentleman,' observes the Secretary to the Government of the Punjab, in a communication to the Government of India, Department of Revenue, Agriculture and Commerce, 'has labored with more interest and success to improve the native industries of the Punjab, and his enlightened exertions for the improvement of the breed of cattle, the introduction on new staples, the development of sugar manufacture, the rearing of the silk-worm, and the manufacture of silk, have been, on many occasions and in various reports, brought under the notice of the Government of India." On his last visit to Calcutta, in the early part of the year, he promised, as soon as he could command the necessary leisure, to contribute certain papers to the journal, the result of his proceedings towards the development of the silk and sugar industries of the Punjab, which, had he been able to com[illegible] them, would no doubt have been interesting and useful.

"The death of Mr. Sulpiz Kurz, Curator of the Herbarium of the Royal Botanic Garden, Calcutta, though he was not a member of the Society, cannot be omitted in this annual record. Mr. Kurz had on various occasions contributed papers to the journal, and his latest, and most valuable on the *Musaceæ* published in Vol. V. Part 3, has been left unfinished by his untimely death in January last at P[illegible]aang, whither he had proceeded in the hope of restoring his health. His botanical researches in the Malayan Archipelago, Burmah, and India have been considerable. His death in the prime of life has deprived science of an unassuming but most ardent votary.

"Work has been well attended to during the past year in the Garden.

Applications for delivery orders (233) have been duly met. Besides these, many supplementary orders have been issued, a fact which shows that many members have availed themselves of their privilege of indenting on the Garden. Of ornamental plants, 8,000 have been distributed to members and of economic plants 4,619, besides sales to members and others of 2,500 fruit grafts, and 1,115 ornamental plants. The demand for rose plants has been so great as almost to exhaust the old stock; and as this class of plants continues to be so popular, it is proposed to introduce next year (1879) a further stock of new varieties.

"The Council has to express their obligations to various correspondents for donations to the Garden; among these may be mentioned the Queensland Acclimatisation Society, the Directors of Botanic Gardens at Mauritius and Singapore, and Mr. T. M. Francis; and for seeds to Dr. King, of the Royal Botanic Garden, Calcutta, the Baron Ferdinand [illegible] Mueller of Melbourne and Mr. H. E. Abbott of Tirhoot.

"A flower show was held in the Garden, the first of the kind in this locality; and though it took place so late in the season as the 2nd of March the collection of plants exhibited was tolerably fair, and the attendance of visitors, members, and others, was large. The amount received by sale of tickets, at one rupee each, from the latter almost sufficed to meet ordinary expenses. This was the first occasion on which a charge was made for admittance; but the innovation passed unobserved, or at least without objection. Ladies and children were admitted free.

"Allusion was made in the last Report to a very important subject, namely blights of various kinds affecting the tea plant, and to the efforts which the Society were making to organize a full inquiry towards its thorough investigation. These efforts have been continued during the past year. Several Agents, largely interested, were quite willing to support the proposed scheme, provided others would join. As however these have failed to respond the Society have been reluctantly compelled to abandon it altogether.

"The demand for useful plants and seeds has been unusually large during the past twelve months, and has been responded to the best of the Society's ability. Among others may be recorded applications for tea and tobacco seeds from Rangoon, Arracan, and the Andamans; Bamia cotton seed for the Bangalore Botanic Garden; seeds of various kinds from the Director, Department of Agriculture and Commerce, N.-W. Provinces, and from the Minister of Public Works in Egypt.

"Various subjects of interest have been communicated and discussed during the year, more especially in respect to sericulture, flax cultivation for the sake its fibre, manures for tea gardens, Arabian date palm *quoad* its cultivation in India, and the utilization of certain plants in times of scarcity, and several others, of which full particulars have been recorded in the monthly Proceedings.

"Two parts of the Journal, 3 and 4 of Vol. V. have been published during the year, and Part I, of Vol. VI. is now in the Press, and will probably be issued in the early part of 1879."

The election of Officers and Council was next taken up with the following result :—

President.—The Hon'ble Louis S. Jackson, C. I. E.

Vice-Presidents.—Mr W. H. Cogswell, Mr. W. Stalkartt, Rajah Suttyanund Ghosal Bahadoor and Baboo Kali Prosonno Ghose.

Secretary.—Mr. A. H. Blechynden.

Council.—Baboo Peary Chand Mittra, Mr. E. Broughton, Mr. R. Blechynden, Mr J. W. O'Keefe, Dr S. Lynch, Mr. W. Waterfield, Baboo Protap Chunder Ghosa, Mr. J. E. MacLachlan, Dr Geo King, Dr. J. B. Barry, Mr. S. H. Robinson, and Mr H. J. Leech.

Baboo Protap Chunder Ghosa's name, was added to the Tobacco Committee; the other Standing Committees need no strengthening, and remain, therefore, as in 1878.

The following gentlemen were elected members :—

Messrs. T. T. Leonard and W. St Clair Grant, the Managers of the Lallacherra Garden, Cachar and of the Paikpara Estates.

The names of the following gentlemen were submitted as desirous of joining the Society :—

A. Wilson, Esq., Merchant, Calcutta,—proposed by Mr. W. H. Cogswell, seconded by the Secretary.

Syed Fazlur Rohman Mogulpara, Patna,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Alister Mackintosh, Esq., Dooreea Factory, Tirhoot,—proposed by Mr. H. E. Abbott, seconded by Mr. T. M. Francis.

Mr. Narsing Row, Zemindar, Vizagapatam,—proposed by Mr. T. H. Mosley seconded by the Secretary.

Leitchfield Moseley, Esq., Manager, Dooars Tea Company, Julpigoree,—proposed by Mr. J. Mackillican, seconded by Mr. S. Cresswell.

W. M. North, Esq., Proprietor, Bogracote Tea Estate, Silligoree—proposed by Mr. Cresswell, seconded by the Secretary.

B. H. Carew, Esq., Assistant Manager, Dim-Dim Garden, Julpigooree,—proposed by Mr. Cresswell, seconded by the Secretary.

Prince Mahomed Furrock Shah Russapugla,—proposed by the Secretary, seconded by Mr J. E. MacLachlan.

Manager, Hunplann Hill Estates, Seebsaugor, Assam, proposed by the Hon'ble A. B Inglis, seconded by the Secretary.

Baboo Narendra Narain Roy, Zemindar, Jemoosh Kandhi, Moorshedabad,—proposed by Dr G. King, seconded by Mr. J. E. MacLachlan.

Rejoined.—Hon'ble H. T. Prinsep, Calcutta; Capt. J. F. Pogson, Simla; Howard Lawin, Esq., C. E., Midnapore; W. C. Tresham, Esq., Cawnpore, and E. A. Thurburn, Esq., Calcutta.

GARDEN.

The Head Gardener's report was submitted, of which the following are extracts :—

"The work since last report has been of a miscellaneous character, the general tidying up of the garden grounds occupying a considerable share of our attention. Propagation and potting of various plants still continue. In looking over the contributions made to the garden, I find that the violets sent to us by Mr. T. M. Francis of Tirhoot are looking very healthy. The seeds of Blighia Sabida sent from Cawnpore farm were somewhat immature, and though they germinated, the seedlings were weak and died off in the course of a few days. I have noticed from the trees in our garden that the fruit nearly always falls to the ground before attaining the size it ought to attain, the fruit is exceedingly pretty, and should be used as a vegetable, whilst small and tender; its specific name is well deserved. The

Australian seeds, presented by Captain C. J. Wilkinson, have, in some few cases, germinated, though they have been sown since 23th August 1878. I noticed in the flower garden that Petunia, Lobelia, and Verbena seeds have germinated vigorously after having lain in the garden soil since last spring; I expect this is owing to their exclusion from the air: this throws some light on the preservation of seed packed in the earth for import. The rose garden has been smartened up, but many plants having died a long time ago, causes it to shew too much soil in *proportion to flowers*. It would be an improvement to re-introduce the same direct from England. If we re-import these roses, we might get *some new kinds also*,—a few caladiums, crotons, dwarf habit palms, *&c.*, and also Liberian coffee seedlings, in large quantity. A portion of the garden might be set apart for their cultivation, as this coffee is eagerly looked for by members and others interested in its introduction on a large scale into India. We should, I think, take as much interest in its introduction as private parties, who, though willing to order for themselves, have not the same facilities of communication as we must of necessity have from our long experience. We have only a few plants in the garden, and what few seeds they give, produce plants after an extremely long interval—the supply being quite inadequate to the demand. Plant houses are being cleaned and regulated and general preparations are being made for the protection of plants during the coming glare of the hot weather."

TOBACCO.

Read a report from Messrs. Anderson, Wright & Co. on some tobacco submitted by Mr. O'Conor of the Department of Revenue, Agriculture, and Commerce. The plant was grown at Myouk-toung in Arracan Hill Tracts, and cured at the Government tobacco farm at that place by Mr. Schoenemann, the Superintendent. The tobacco is considered a good article, not unlike what is known in Calcutta as Hinghlee and which is much appreciated by the Ooria buyers. For export in the present state of prices in Europe it would be but of little value.

COTTON.

Read the following report from Mr. W. H. Cogswell on certain specimens of cotton (New Orleans, Upland Egyptian, Bamia, Naukin, Hinguughat) raised in the Saharunpore Botanic Garden, and forwarded by Mr. Duthie, the Superintendent :—" I have very carefully examined the samples of cotton grown at Saharunpore Botanical Garden, which I consider most creditable. I should have been better able to give more of a detailed report had some of the cotton been removed from the bolls ginned in the usual way and the seed removed. I place opposite the names of the samples the classifications, as I think the trade would accept them in England, on the assumption that they had been grown in the countries from which the seeds has been imported and not in the garden above-named, as I am of opinion that the quality is very little, if any, inferior to those descriptions grown on their own soils."

Read another report from Mr. Cogswell, on some cotton raised in the Meerut District, by Emtar Ali Khan, a Zemindar, from seed brought from Mecca, and of which a small sample was previously received, too small to report on. " This sample as now seen in quantity," observes Mr. Cogswell, " is not at all like the small sample sent to you in a letter. It is very red, most irregular in staple, the bulk of it being almost worthless, here and there portions of staple equal in length and character to Rangoon ; anything but a desirable article of commerce, and probably not worth more than Rs. 8 to Rs. 9 a maund, as against Rangoon at Rs. 14 to Rs. 15. From its very mixed quality and condition, I think it has been badly prepared, and that more might be made out of the seed under a careful cultivation, picking and ginning."

CROCODILE OIL.

Read the following report from Dr. Kanny Lall Dey, on a sample of Crocodile oil received from Mr. Purcell of Agra. Mr. Purcell intimates that if of any commercial value, he could obtain a large quantity of this oil.

" I submitted to comparative examination the Crocodile oil with other animal oils, with the following result :—

" Crocodile oil contains a larger proportion of solid fat than either the Neats-foot or Codliver or other fish oils. It solidifies at the melting point of ice, while Neats-foot only slightly thickens, and the others scarcely thicken. I have also tried the softening quality of the various animal oils on leather, and on comparison I find the leather treated with Crocodile oil remains much stiffer than others treated with other animal oils.

From the above results I do not consider that Crocodile oil has as much commercial value as Neats-foot oil."

LAC ON TEA BUSHES.

Messrs. A. R. Mackintosh & Co. sent some cuttings from tea bushes at Lizziepore Garden, Kurseong. The Manager thought the bushes were being covered with lac, but this seeming doubtful, they ask for a report thereon. The Secretary stated that he had referred these infected twigs to Mr. Cogswell who had obligingly reported on them :—

" I have examined the small twigs of the tea bush which bear a deposit and for which you seek a name. It is most difficult to do so. It is an unmistakeable resin and I am half inclined to think that it is the deposit of the lac insect, kermes lacca or ' Coccus, laccus' It contains dye or slight coloring matter to a very small extent only, as the enclosed test I have made will show. That, however, may be attributable to the fact that the insect had only just deposited the eggs which had not time to mature when the branches were cut.

" I may mention that these remarks refer to the twigs that you first sent to me, from a portion of which deposit I made the experiment not to the accompanying ones. A close inspection of the two will show you that the difference is in the latter sample having the deposits of a greyish white color and much less matured than the former.

" I am sorry that the deposit is not more matured, that fact renders this opinion somewhat uncertain.

NEW MODE OF MULTIPLYING PLANTS.

Read the following letter from Mr. T. M. Francis, in continuation of his previous communication submitted at the General Meeting in November last :—

" With reference to my letter, describing the American process of striking cuttings of hard-wooded plants by burying them upside down I have now the pleasure to report on an experiment which I have made.

" On the 19th December 1878 I buried 20 bundles of cuttings, taken from the prunings of my rose trees. The roses so treated were *(inter alia)* Alba Rosa, Beauty of Waltham, Deuil de Prince Albert, General Jacqueminot, John Hopper, Jaune D'Or, La France Marechal Niel, M. Ravil, Mme. Charles Vardier, Mme. Laffay, Murrillo, Prince Camille de Rohan, Reine des Violets, Solfaterre, and Souvenir de Wm. Wood. I only put down a few cuttings of Marechal Niel and Solfaterre as I was doubtful whether they would succeed.

" On the 5th February 1879, I disinterred the cuttings by turning the box which contained them upside down, (I must premise that the box had been left during the above period exposed to the sun, the earth being moderately watered every morning and covered with a *jhâmp* or mat every evening.) As each bundle of cuttings was taken out, I put its lower end into a pail of water in which the cuttings were carried to a spare bit of land which I had previously enriched with *koonee*, *i. e.* well rotted indigo refuse. Here the cuttings were sorted and planted out at intervals of six inches. Those which were dead or had failed to form a callus, were put aside in a basket. When the planting out was finished *all* the cuttings were carefully counted. The result is as follows :—

Cuttings originally buried	437
Failures	107
Callus formed on	330

" This may, I think, be regarded as a success, and the results would have been still better, but for a tame mongoose of mine which scratched away the earth from the cuttings on three several occasions, thus exposing the lower ends, which were of course uppermost.

" Every callus was well formed, and in most cases the leaf buds were well developed and ready to start. In some cases they had actually started and were pushing towards the light, so that they were obliged to reverse their natural growth.

" In many cases I found that a callus had formed at *each* end of the cutting. I selected six of these for a further experiment and cut them in halves, planting the lower ends in the plot of ground which I had prepared and putting the upper ends into flower-pots with good soil. I will let you know the result of this experiment. If it succeeds, I can claim the credit of raising plants from cuttings *planted* upside down. I shall be glad to know if this has been done before. My horticultural library is limited, but I cannot find in it any account of this reversal of the laws of Nature, having proved successful in its results. The six cuttings, thus treated, are of course distinct from the 330 on which a callus had formed ; and if they take, I may claim a further success

" Hence-forth I shall always use the American process for hard-wooded cuttings, and I trust that my success will induce many other Members of the Society to give this process a trial.

" About half the cuttings of Marechal Niel and Solfaterre succeeded well, I rejected *all* doubtful cuttings in order to give a fair report."

Letters were read :—

" From F. Moore, Esq., India Museum, London, respecting some diseased tea leaves (red spider) from the Tukvar Tea Co. Gardens, Darjeeling—(*See* proceedings for September, last.)" These tea leaves, " remarks Mr. Moore," are infested with a species of coccus, which is apparently, quite new both as to its attacking tea and in regard to its species, so far as I have been able at present to determine. In the small perforated tin box which was also duty received, and in which you mention was an insect from the Cossipore Tea Garden in Cachar, which was found by Mr. Edgar on a partially eaten tea leaf, I could find no vesting of an insect. This doubtless escaped through the perforations during transit. I much want to get good specimens of the *Psyche* or case-bearing insects which is stated to attack tea plants. Will you kindly send me specimens, if possible, of both the cases and the moths ; the latter particularly'. "

From Colonel W. H. Lowther, Benares,—presenting a paper on Capsicum and Chillies (Transferred for Journal).

From E. Buck, Esq., Director, Department of Agriculture, North-West Provinces, forwarding reports of trials of the Prickly Comfrey at Saharunpore and Kumaon. Transferred for Journal.)

Mr. Lynam sent for inspection a well grown plant, in flower, of *Oncidium (sphacelatum majus ?)*

Mr. Manukjee Rustomjee, also sent for inspection, an unusually large specimen of a native pumpkin or bottle gourd—native name *Laoo* (*Cucurbita Lagenaria*.) This pumpkin measures 4 feet 9 inches in length.

Baboo Protapa Chundra Ghose placed on the table specimens of tobacco, sun-cured, fire-cured and air-cured, and cigars made therefrom, which he considered the best he had seen. This tobacco was raised and prepared at Messrs. Begg, Dunlop, & Co.'s plantation a Poosa.

FORESTRY.

It is stated in the *Proceedings of the Californian Academy of Science*, Dr. Kellogg knows of only two trees which are perfectly proof against the Teredo navalis or pileborer of tidal water. These are the Palmetto, Chamærops Palmetto, and the Australian Eucalyptus rostrata. The Teredo will attack the wood of Eucalyptus globulus, and many other species.

A Giant Tree.—A patriarch of the forest has been lately felled in California, and the greater portion of the wood taken to San Francisco. It was known by the epithet of "Old Moses." If one might infer with accuracy its age from the number of its rings, it must have been 4,840 years old. Its capacity is said to have been so great that 360 persons could find room within its trunk.

Fever Trees.—Chr. D. Van Lennep, Swedish Consul at Mahazik, near Smyrna, writes as follows to the *Times*:—The cultivation of the willow is recommended by one of your correspondents for districts affected with malaria. His statements on the subject being fully borne out by my own experience in the well known malaria regions about Ephesus, I beg, through your columns, to call thereto the attention of the authorities in Cyprus. Before the *Eucalyptus* was ever heard of in Asia Minor, I had seen the bark of the willow used as a febrifuge.

It has been announced that the following gentlemen have been selected by the Secretary of State for India from the candidates who presented themselves for preliminary examination in November, to undergo the usual course of training in a French Forest School, to qualify them for appointments in the Indian Forest Department:—Messrs. F. S. Barker, O. E. Brasier, E. S. Carr, M. H. Clifford, J. H. Lace, and J. Rawbone. It is said that both as regards the number and attainments of the competitors, there was an advance on previous years. There were about forty applicants, for the five appointments which were advertised, and six nominations were made.

Forest products of China.—The northern provinces of China are very little wooded, with the exception of Sh'engking, which still possesses forests of oak, comprising about three varieties—*Qurcus obovata*, *Q. Mongolica*, and *Q. Castaneæfolia*, and also *Pinus sinensis*. The last tree is found nearly all over China. The first do not exist in the north, but in descending southward we meet at Ningpo Cunning *Lamia sinensis*, and *Abies kaempferi* We find abundantly grown at Shantung, the *Paulownia imperialis*, and *Catalpa bungeana*. The Cypress and the *Thuja orientalis* are grown as shade trees in the cemeteries and serve to make coffins. Lower down are found *Rhus cotinus*, and *R. semialuta*, the *Rhus vernicia*, which furnish the famous lacquer or varnish of China, and the *Elaeococca*, the seeds of which yield an oil. The poplars are chiefl found to the north of the Yangtze, where there are four species—*Populus tuyang*, *P. venusta*, *P. coriacea*, and *P. acuta*; their light wood is employed in the construction of junks. In the central provinces, besides the oil-tree *Elaeococca vernicia*, we also find the tallow tree, *Stillingia sebifera* and the vegetable wax-trees, *Rhus succedanea*, *Ligustrum glabrum*, and *L. japonicum*. In the neighbourhood of Shanghai, Soochow, and Kiangsu large plantations of mulberries *Morus alba*, are met with, the leaves of which nourish the silkworms. Further still we find the paper mulberry *Broussonetia papyrifera*. The pods of *Gleditchia sinensis* furnish a native soap. The wood of *Memia asadirachta* are employed at Canton for cabinet work That of *Laurus camphora*, which is found in Southern China, and especially in Formosa, furnishes by distillation the camphor of commerce, and is also employed to make boxes to keep clothes and furs in, as its odour is obnoxious to insects. The *Cassia lignea* of Kwangtung and Kwangso, furnishes a bark somewhat similar to cinnamon, which is much employed in Chinese cookery. These two provinces, as well as Yunnan, and the islands of Hainan and Formosa, have the bread-fruit tree *Artocarpus incisa*, the areca-nut, cocoanut, and other palm trees, the wood and leaves of which are much employed in building, for making fans, &c. *Chamaerops excelsa* and *C. Fortunei* produce a sort of fibrous thread, employed in making cordage, brushes, &c. Of the plantain there are in Formosa more than twenty varieties and on the coasts of that island and of Hainan, we meet the pandanus, the mangoe, the banyan fig, the *Ficus repens*, and other tropical trees.

TRAINING OF YOUNG FORESTERS FOR INDIA.

(*To the Editor of the Journal of Forestry.*)

Sir,—In a correspondence on this subject between the Indian Government and her Majesty's Secretary of State for India, we have in a communication marked No. 6, dated Calcutta, 1877, the following paragraph (para. 21):—"The art of planting larch and other coniferous trees has been brought to great perfection in Scotland, and is well understood in many parts of England, but forestry in Great Britain, we are informed [a saving clause], is limited to empirical skill in certain operations which succeed well under certain conditions of soil and climate. There is no system and no science of forestry in Great Britain, and the forest estates being with few exceptions private property, and are much smaller than the State forests of France and Germany, the student educated in the forests of Great Britain could only under the most favourable circumstances learn certain operations, the success of which [*sic*] based entirely on empirical knowledge, and the advantage of this sort of knowledge in India would be insignificant." This is a severe reproach to British forestry. According to the Indian Forest Department we depend entirely on chance for success. That forestry in Great Britain has no more claim on the science of arboriculture than is regulated by soil and climate, and that our science and practice of forestry is limited to the planting of larch and other coniferous trees. It must be admitted that we have not studied the science of forestry as much as we ought to have done, but it is a libel to state that our arboricultural knowledge is purely empirical; we have men as well posted up on the physiology of plants, who are quite as able to treat on plant pathology empirically and mechanically as can be found anywhere else. Talking of what the students learn at Nancy, we have it stated in para. 20 of above communication that "they learn it is possible to protect and manage State forests efficiently though they are not fenced. They become familiar with the natural regeneration of forests [this is stated to be of paramount importance to India], and they learn to understand and to respect the management of extensive forests according to a regular detailed plan of operations." Every intelligent forester will concur with me when I term this a mere course of elementary training, and in principle it is thoroughly understood among British foresters. Again, we have on the authority of Dr. Schlich, the Conservator of forests of India, that "the training necessary cannot be learned anywhere else out of India." At the same time he admits that "the two years' training at Nancy gives young men such an insight into the principles of forestry that they are at once able to be useful in India, and they come prepared to acquire in a short time more practical knowledge." The bare fact that after two years' training in a school of forestry young men have only got an insight into the principles of forestry will I should think, stagger some of your correspondents who are clamouring for a British School of Forestry. No, the time has not come for that yet, but if the Scottish Arboricultural Society would inaugurate competitive examinations, making it absolutely necessary that a certain standard of proficiency in the elements of geology, botany, chemistry, and mineralogy, must in every instance be attained by pupils having a practical knowledge of all the various duties connected with estate management, the Secretary of State for India could then have no difficulty in selecting his annual complement of five young men well qualified to proceed to India. I hold that the science of forestry is in every country and clime identical, although its application slightly varies under different circumstances. A British forester trained from boyhood acquires a thorough practical knowledge of the culture and management of trees, their adapation to soil, their physiological properties their habits, growth, and their relative value, nor does the scope of his experience end here; even though we have men at the present day arguing that young foresters ought not to trouble their heads with anything outside the planting of trees, he is taught to lay out and superintend various works besides those solely forestal. Although having stated this much, I am not to be taken up as recommending young men to be kept as mere drudges, as I regret to say they must feel themselves according to our present system, spending years of their time learning not a *science*, but a *mechanical art*. I therefore repeat what I stated in a former letter, that by the Scottish Arboricultural Society issuing an exhaustive code of instructions, and instituting annual examinations, the same will act like an "open sesame" to India.

D. SYM SCOTT.

Ballinacourte, Tipperary.

THE EFFECT OF COAL TAR *vs.* QUICKLIME ON UNDERGROUND TIMBER.

(*From the Brazil and River Plate Mail, Dec. 7*).

At the Framwellgate Colliery, some time since, an experiment was made to ascertain the comparative preserving power of coal tar and quick-lime upon the underground timber, as compared with each other, and with unprepared timber. On September 29, 1849, three larch tramway sleepers, each three feet long, two and a quarter inches thick, and five inches wide, were selected, and placed in the air course of the Hutton seam. No. 1 sleeper was prepared by receiving two coats of coal tar, No. 3 was in its unprepared or natural state. The three sleepers were supported at their ends by small pillars of bricks, and weighted in the middle with fifty-six pounds of metal. On January 6, 1852, the unprepared sleeper was found broken and quite decayed. On November 1, 1854, the sleeper prepared with tar was found broken and decayed. On December 23, 1856, the sleeper coated with lime was

discovered in a similar condition. From the above it appears that No. 3, or the unprepared sleeper, broke after two and a quarter years exposure. No. 2, or the tarred sleeper, broke after five and a half years. No. 1, or the limed sleeper, broke after seven and three quarter years. And that the sleeper prepared with tar had a duration of 2·84 years beyond the unprepared one, while the white washed sleeper survived the same for five years, and the tarred one for 2·16 years.

THE FLORIDA ALLIGATOR TREE.

THE noses of *Eucalyptus globulus* and of other *Eucalypti* are out of joint! It has been discovered that the Florida Alligator Tree will not only destroy malaria, but that branches or even twigs, if kept in the rooms of our dwellings, will prevent all sorts of diseases whatsoever. No wonder, then, that of late hundreds, in fact thousands, of happy men, and ladies, and children might have been seen passing to and fro the streets of great New York with a branch of the Alligator Tree in their hands. In almost every street bundles of these have been offered for sale at five or ten cents for each branch—"take your pick." "The great Alligator Tree of Florida. It will cure anything, Sir You have only to put one of these branches in your room. It will exude a sweet, balsamic odour which purifies the atmosphere and bids defiance to disease!"

In the moist delightful woods of hill or valley of the Northern States running westward to Illinois and southward may be found the Sweet Gum. Its leaves are like those of the Maple, except that in the autumn they change to a deep purple, sometimes beautifully mixed with orange. When bruised, the leaves emit an aromatic odour at all times, but in the spring, just after they are unfolded, and especially after a shower, the air is redolent "with their refreshing odour." The gay grey bark, especially upon later growth, is curious for its corky ridges that sometimes form corrugated plates an inch in width Its botanical name is Liquidambar Styraciflua. Millions of trees may be found within fifteen miles of New Jersey. But how could our city people be expected to know that! When *they* go to the woods they are too enraptured over everything to notice anything in particular!

When, therefore, twigs of Liquidambar Styraciflua are offered to them in the streets of New York as the Florida Alligator Tree, and they are assured of their wonderful powers, is it not quite natural that they should buy a twig or so for ten cents each and hasten on to their homes with a lighter step? *American Paper*.

AUSTRALIAN TREES IN CEYLON.

WE are much indebted to a correspondent who writes on the altitude at which blue gums may be expected to grow, but the latitude of Portugal must be taken into account, and there is cold to counter-balance the exceptional heat noticed. In Europe the *Eucalyptus* grows at sea level, and it is frost which has to be guarded against and not heat In India the blue gum will not flourish on the plains, even so far north as Lucknow. Here, in Ceylon, we have never seen the blue gum growing under 3,000 feet, though we have seen it flourishing on Horton Plains at 7,000. There is one of the most beautiful and most valuable of the Australian trees, however, which will ultimately be one of the most valuable additions to our scenery and our timber resources We refer to *Grevillea robusta*, specimens of which are pretty common in Colombo—notably at Mr. Cecil Ferdinand's house, in the Cinnamon Gardens, and which are readily recognized by their exquisitely beautiful fern-like foliage The *Grevillea* will not stand the full force of the sea breeze like the *casuarinas*, but will grow close to the sea if sheltered. There is a tree in front of Villa Sorento, on the Kollupitiya road, which proves this. Travellers by railway will notice a handsome group of *Grevilleas* opposite the Peradeniya railway station When up country at the end of last year we found *Grevilleas* which had been planted at a bungalow in Upper Dimbula in June 1873, throwing out rich tufts of deep orange-coloured blossoms, and we suppose seed has followed From considerably older trees at Mount Vernon bungalow, self-sown seedlings had been obtained, and the Peradeniya trees were shewing blossom and seed. The *Grevilleas* are seeding in many other places, so that now there is the prospect of a plentiful supply of locally produced seed of a tree which is superior to the blue gum for purposes of ornament and use. It is a capital break wind, and the timber is highly valued in Australia. The reasons why the blue gum (*Eucalyptus globulus*) is so general a favourite are that the seeds germinate freely and the trees grow so rapidly. But the trees are liable to be blown down or broken, much more so than the *Grevillea*, which we have seen at 4,700 feet altitude, becoming a fine well-grown tree, producing blossom and seed at a little over five years old. The gums, both blue and red are valuable, but other Australian trees and trees from other countries should not be neglected. The time is rapidly approaching, we suppose, when supplies of seed from locally grown Australian trees of the best quality will be plentiful.—*Ceylon Observer*.

AVENUES ON DISTRICT ROADS.

MR. CHAS. S. NOBLE writes to a contemporary.—I have recently seen the great success that has attended a simple measure adopted eleven years ago by a former deputy commissioner in the Unao district, a measure by which the district roads there have, to a larger extent than I have as yet seen elsewhere in Oudh, been provided with well grown avenues of mango and mahua trees. The trees too are remarkable for their straight, vigorous growth (a feature rarely seen in avenues planted and reared by Government officials), showing how perfectly they have been preserved from injury by cattle. The plan that secured this desirable result was as follows —Zemindars and cultivators were invited to plant trees upon the roadsides, and were assured that Government would in no way interfere with the planter's right of property in the trees Many persons accepted the invitation, and, as I have already described, their labour and care has worked, and is working, a great public good. Trees, as they grow to maturity, make the soil on which they grow unfit for other crops, and, for this reason zemindars do not encourage their ryots in planting trees in khets that border Government roads. I make the following suggestions, which, if adopted, might perhaps induce many cultivators to plant useful fruit bearing trees on sides of Government roads. Tehsildars and managers of Courts of Wards' estates should make it known in those villages that lie near district roads 1 — That permission will be given to plant trees "within" the road boundary, at a distance not exceeding 3 feet from the edge of the road 2 —That "sanads," signed and sealed by the deputy commissioner, will be given to each person who wishes to plant, specifying the number of trees to plant which permission is given, and the particular bounds within which they are to be planted. 3 —That a register of such "sanads" will be kept tahsilwar, perganawar and mouzahwar at sudder, and at each tahsil, in which register all changes of proprietorship in the trees will be noted as they occur 4 —That the trees to be planted will be limited to (I) mango, (II) tamarind (III) mahua, (IV) jamun, (V) kathal or jack fruit. The form of sanad might be as follows —

SANAD.

Ramdin, age 30, Kurmi, resident of Pirpur, son of Kalidin, is hereby given permission to plant 28 trees within the limits of the Government road leading from Rae Bareli to Garbakhshganj. The site for the trees is as follows - On the east side of the road 14 trees from Khasra No 167 to Khasra No 199 of Mouzah Pirpur. On the west side of the road 14 trees from Khasra No. 209 to Khasra No 237 of the same mouzah. The trees are to be planted not more than 3 feet within the extreme edge of the road, and the thalas are to be 15 yards apart from each other. The trees are to be mango, tamarind, mahua, jamun or kathal (jack fruit). All the fruit and income from the trees will be the absolute property of Ramdin Ramdin shall not at any time cut down or lop the trees without first obtaining the permission of the deputy commissioner. Ramdin shall have the power to sell or mortgage his title and interest in the trees and he shall notify the fact to the deputy commissioner within 15 days of sale. Should Government have to lop boughs, or to cut down a tree althogether, the value of the wood, after deducting cost of cutting will be handed to Ramdin.

Some improvements on this scheme may suggest themselves to district officers, but such as it is, I send it to you with a request that you will kindly publish it in your paper *pro bono publico*.

The Planters' Gazette.

TEA.

ACCORDING to returns presented to the Government of India, there were in 1876 77, in the Madras Presidency, forty-four tea estates at an average elevation of from 3,500 to 8,000 feet. The acreage "under mature plants," was 1,514, "under immature plants," 1,628. In addition to this area, 2,341 acres have been taken up for planting, but have not yet been planted. In the whole of India in 1876 77, there were about 130,000 acres under mature plant

THE *Indian Tea Gazette* informed its readers some time ago that "a noticeable feature in relation to the tea industry in Ceylon is the formation of a central manufactory in Colombo for tea from estates in the Island The leaf is sent down withered, and is then manipulated. The experiment is only to be regarded as a safe one if the withered leaf can be delivered in reasonable time." From enquiries we have made in Ceylon we find that this information is not correct. The leaf is manufactured at the estates and sent down to Colombo where there

is an establishment for *bulking* the tea, similar to establishments at the principle export stations of China tea. The central manufactory in Colombo is a bulking house.

It is not at all improbable that tea will before long be exported in a compressed state. Machinery of a very interesting kind, is in operation at the factory of Messrs. Goundry and Co., in Upper Thames-street, London, for the purpose of compressing tea into that solid form which has been found to be the most convenient for stowage, and in many respects advantageous to consumers. Of late, testimony has been borne by high authorities to the important benefits which are to be derived from the system of crushing tea in so forcible a manner as to preserve all its qualities, while greatly diminishing its bulk. The tea before being pressed is put up in quarter-pound parcels, and each machine employed in this work turns out 9,000 packages, or one ton per diem; and a pressure of no less than 40,000 tons is brought to bear on every 140 lbs. of tea. Hydraulic machinery of compound power, which is obtained by a patented appliance, enables this pressure to be exerted within a very short time, and the rapidity of the process is one of the great advantages possessed by this Company as a defence against imitation. In the presence of a few connoisseurs and experienced tea-tasters, a trial was made of the Goundry compressed tea against the same leaf as that from which it is formed—with the results that a portion of the tablet, weighed against tea in a loose state, was found to yield a liquor of much deeper colour and strength. At the same time an infusion was made from loose tea, 50 per cent. of weight being added; and this was about equal to the yield of compressed tea, which was but two-thirds the quantity. Then a second draw was tried; and though it might have been expected that an exhaustion of the crushed tablet had followed on the first brew, such was by no means the case, the relative results being the same on repetition. As to flavour, it appeared as if the process of compression, which had so remarkably changed the colour of the tea from deep black to an autumnal green, had likewise restored the leaf itself by the fracture and blending of all the internal particles to that virgin freshness of aroma which is agreeable to all tastes.

The fifth annual report of the Phœnix Tea Company of Cachar Limited, has been submitted to the shareholders, and we observe therefrom that the year has been fairly successful.

Had severe blight not attacked the garden generally, and a hailstorm not devastated the second division (Appin) in early spring, the outturn would have been considerably exceeded, and the profits proportionately enhanced.

Careful manufacture however has made up for the difficiency in the crop, by producing good marketable teas, that have sold well.

The expenditure has been somewhat greater than estimated, but this was *partly* due to the high price of rice ruling in the province, *partly* to the unhealthiness of the season, thus increasing the force of sick and feeble, and *partly* to cost of extra extensions undertaken, after the last report was issued, which was not provided for in the estimates.

Besides the 28 acres of garden opened out and planted prior to January 1878, other 50 acres of low lying flat land were drained, and are now being planted out from old *reserve nurseries* of "hybrid" seedlings, which, when yielding, will give handsome returns.

It appears that there are some hundreds of acres of this description of land on both divisions, that can be reclaimed, and made available for tea cultivation.

The system of shipping the teas direct to the Home market has worked most satisfactorily; not only have the chests arrived in good condition, but the weights have been fully maintained. Result seldom experienced in Calcutta bought teas A Dividend of 7 per cent. has been declared.

The operations for the ensuing season are well advanced: Pruning is nearly finished and all the gardens are under good cultivation: buildings are receiving the ordinary annual repair, and most assuring accounts have been received from the managers as to future prospects.

The estimates for 1879 are as follow :—

Estimated crop at "Bundookmara" 1,950 maunds=1,56,000 lbs. valued at 13 annas per lb.... .. Rs.	1,26,750 0 0	
Estimated crop at "Appin" 700 maunds=56,000 lbs. at 13 annas 6 pie per lb. ... ... ,,	47,250 0 0	
		Rs. 1,74,000 0 0
Expenditure at "Bundookmara" Rs.	65,300 0 0	
Ditto "Appin" ... ,,	26,207 0 0	
		Rs. 91,507 0 0
Surplus over Factory expenditure ... .. ,,		82,493 0 0
After deducting cost of stores and agency charge, &c. ,,		25,000 0 0
Estimated nett profit for disposal of ...		57,493 0 0

Calculations which the Directors have good grounds for believing will be realised.

The Directors observe at the close of their report :—

"The rates of 'Bonus,' given to time-expired coolies for renewal of agreements, have been greatly reduced, and we hope in time to see this objectionable and burthensome item of expenditure entirely abolished.

"The introduction of machinery, and the stoppage of extensions in the province—by lessening competition—have brought about a better feeling, and established a higher tone throughout the district, which is much to be lauded."

COFFEE.

A CACAO planter in Trinidad states that he has trees which yield him 15, and even in very good years 18 lbs. of clean dry cacao, at a gathering. This is a great but not an incredible yield, since Purdie got an average of 11 lbs. at one gathering from some old and neglected, but re-trimmed and properly cleaned trees in the garden, and Lunan—1814—relying probably on Blume—1672—says the annual produce in Jamaica's cacao period, two centuries ago, was generally estimated at 20 lbs. a tree, and averaged, good and bad seasons together, 1,000 lbs. per acre (=8 lbs. a tree, at 18 ft. apart—the usual distance there, at that period), although in poor soil, and under bad management, the yield per tree rarely exceeded 8 lbs. a year. Cacao cultivation in Jamaica died out in consequence of the excessive duty then imposed on it at "home," and the wretchedly small consumption of that day, partly owing to that fiscal imposition; and only now is painfully and with effort struggling to regain a place as a regular cultivation. It is very far from being worthy as yet of coming under the title of a staple of the old Colony.

From the last annual Report on the Government Garden at Rangoon we observe that the experiment of introducing and acclimatising Liberian coffee has up to the present time been entirely successful. On the 4th August 1877, the Agri-Horticultural Society of Madras sent to the Government Gardens at Rangoon 50 very small plants of Liberian coffee, which had been originally sent out from Kew. These were distributed as follows :—

Agri-Horticultural Society of Rangoon	18
Dalhousie Park at Rangoon	6
J. H. Gilbert, Esq., Rangoon	6
Commissariat Office, Thayetmyo	6
Government Gardens, Rangoon	11
Died	3

The 11 plants retained by the garden were kept in pots until the 22nd May 1878, when they were planted out on a sloping piece of ground, the site being selected with the view of trying various degrees of shelter, from perfect shade at the one end, to full exposure at the other. Small pits were dug, and, the soil being very poor, little manure was added; but no unusual care has been taken of the plants, it being considered best to grow them under the conditions to which they would be subject in an ordinary plantation. From a height of 12 to 18 inches when first planted out they have now increased to 2½ and 3 feet, with fine healthy deep-green leaves, some of which are over a foot in length. A further report on these plants, we observe, will be made next year. The ordinary coffee shrub (*Coffea Arabica*) has long been growing in the garden: it flowers and fruits annually, but can hardly be said to thrive.

A correspondent writes to the *Ceylon Observer* :—"A Liberian coffee plant, one of a few planted out on trial on an estate in this valley, has just blossomed. This plant was some 5 inches high, with two pairs of leaves, when planted out in November 1877, and in August 1878 threw out its first primaries, then 2 feet 9 inches high. It has now, in January 1879 (height 5 feet 2 inches), thrown out a few blossoms, and most of them have set.

Three of the other plants on this estate are from shoots, which were removed from young trees, and immediately put into pots. These are now fine healthy plants over 3 feet high, and were only planted out in September last year. Liberians, therefore, would seem to thrive in this valley.

Some cacao nurseries have been laid out with the view of their being planted next season, and will no doubt receive a fair trial, for good forest is now being felled for the purpose, besides plants intended for vacancies in patches of cocoanut.

The effects of the dry weather are already visible throughout the valley. Fences of *endaru*, at other times full of leaves, are now nearly bare, and branches of the cocoanut are found drooping on all sides, the young bearing trees seeming to suffer most.

The new road from Kotadeniya to Mugurungampola has been completed, and is already adding to the railway receipts at its station at Mirigama. It is to be hoped that the few remaining bridges put up in the *primitive* style (of jungle sticks covered over with earth) will shortly be replaced by more durable ones, otherwise the road will soon be impracticable for wheel traffic. It has already a heavy cart traffic of staves for casks sent to the railway for despatch to Colombo.

COFFEE LEAF-DISEASE.

THE following letter which Mr. Morris has addressed to the Hon'ble G. A. Talbot and which is published in the *Ceylon Observer*, gives further information respecting the efficiency of flowers of sulphur as a remedy for leaf disease:—

"Royal Botanical Gardens, Feb. 13th, 1879.—After working out a series of experiments with Mr. Wall's fumigating process and noticing the great vitality of the filaments and spores of the *hemileia*, even after applying fumes which almost destroyed the foliage of the trees, I thought it desirable in the interest of the great consequences involved to go carefully over my former experiments in order to place the efficiency of flowers of sulphur as a specific for leaf disease beyond question.

"Dr. Thwaites was also very anxious to observe the various stages of the experiments, and apply such crucial tests as might enable him to speak with confidence and authority respecting the value of flowers of sulphur as a specific for coffee leaf-disease.

"We accordingly devoted the greater part of this week to critical examination of leaves from sulphured trees. I hope to give fuller details of our work at a future date, but you will no doubt be glad to learn that the conclusions arrived at in our experiments at Wallaha have been very fully and satisfactorily borne out. Dr. Thwaites desires me to say that he is *completely satisfied* that flowers of sulphur can be applied with every hope of success in checking the ravages of the pest which has so long affected coffee enterprise in Ceylon.

"Though the effects of flowers of sulphur on the trees were very gradual during the present dry weather, we watched with great interest its slow, but certain action upon the filaments and spores of the *hemileia*. In no instance were the young leaves, the buds or the blossoms affected by the application of sulphur, and the result of our observations lead us to believe that if flowers of sulphur be generally applied to coffee trees, this year ought to see a great diminution of leaf disease on all well cultivated estates."

LIBERIAN COFFEE.

AT the last monthly meeting of the Madras Agri-horticultural Society, the Secretary read a letter from James Grant, Esq., Manager, Scottish Indian Coffee Company, Limited, Colachel, Travancore, dated 12th December 1878, forwarding the following interesting report on the Liberian coffee plants sent to the Company on the 16th August 1877, written by one of the Company's Superintendents:—"Owing to the case having miscarried and being broken in transit, only twenty-five of the fifty plants forwarded from Madras were received alive at Strathmore Estate. On breaking the small pots, the tap roots were found to have become very much twisted and entangled with the fibrous rootlets, in their endeavours to find an exit from the small pot in which they had evidently been too long confined. Great care had, therefore, to be exercised in transplanting so as to disturb, as little as possible, the soil in which they had arrived. The tap roots, owing to their great length and twisted condition, had to be freely pruned and dressed previous to transplanting; but, as has since been proved, this would appear to have acted beneficially in promoting their rapid growth, as, of the whole twenty-five plants received, all are alive and are shewing marked signs of their adaptability to the soil and climate in which they are now flourishing. Holes, about two feet square, were made for their reception, in a small piece of forest land clear ed specially for the purpose, and were filled with virgin soil from the adjoining jungle. Each hole is about eight feet from the other; but the present appearance of the plants would seem to indicate this distance as being a little too close for the future full developement of the tree. The plants, after being put out, were at first slightly shaded, and watered, when there was no rain-fall, every second day. The shade and watering were afterwards gradually dispensed with, as the plants shewed signs of having established themselves firmly in the ground and when indications of their making young wood were discernible. Several of the plants are now shewing from three to four pairs of primaries and carrying in some instances leaves measuring 16" + 9." The plants are now a little over a year old, and are from 5 to 8 feet in height—the elevation of the land in which they are planted being about 800 feet above sea level, and preserving a moist, warm, and very forcing climate. One plant which was sent to another part of the country and planted under similar circumstances, but at an elevation of some 450 feet above sea level, and with a western aspect, has attained even a larger growth than those at Strathmore. But although nearly 6 feet in height, it shews a tendency to be more *lanky* and perhaps less robust or hardy looking. Another experiment was tried on an estate possessing particularly fine and friable soil, at an elevation of about 1,400 feet above sea level, and even in this instance the appearance and rapid growth of the plant are everything that could be desired. I regret, however, to observe that, even in the case of the two isolated plants just referred to this species of coffee shews no signs of possessing immunity from the dreaded leaf-disease (*Hemileia vastatrix*); but on the contrary the plants were, almost without exception, all attacked with fungus before they had been any length of time in the ground. As yet, however, it is not apparently of a very virulent type, and I hope in a future report to be able to state what effect the disease may have in the bearing capabilities of this description of coffee. In conclusion, I would suggest the extension of the cultivation of Liberian coffee in the lower ranges of the Travancore Hills, where the ordinary description of coffee cannot be successfully cultivated owing to the protracted drought during the early months of the year; and am of opinion that both soil and climate are well suited for its proving a remunerative speculation." It was resolved, that Mr. Grant and Mr. Anderson be thanked for their Report and informed that the Society will be glad to have further reports, as to the success of this important experiment.

The Honorary Secretary reports that one of the Liberian coffee plants received from Kew on 17th July 1877, and planted out in the open in the experimental garden, on 25th February 1878, produced ten blossoms on the 14th December last, and seems to be in good health and likely to mature its fruits; also that another planted in the shade has several buds upon it; and that the flowers are so large and beautiful that he thinks the plant worth growing for them if not for its fruit.

AGRICULTURE FOR PLANTERS.

BY A. C. DIXON F.C.S., M.R.A.G.S., B SC. & SCI. M.B., (London.)

Continued from page 105.

ALTHOUGH cattle manure is most valuable yet its supply is no equal to the demand, nor will there be but a very limited quantity until more attent ion is devoted to the growth of fodder crops for con version into flesh and manure. There is a considerable demand for animal food, and the profit which might be derived from the sale of cattle reared with that object, together with the manure yielded would amply repay cost. As matters stand at present cattle manure is bulky and produced mostly in the low country: this coupled with costly transport stands in the way of such free use of this manure as would otherwise be the case, therefore the only way to meet the difficulty would be to grow large quantities of fodder in connection with estates,—and further, I do not advocate the use of fat meat in the warmer parts of the island, but for those who really prefer such, it could be produced up country. Fattening cattle down here is not natural, and if such practice be pursued, we may then look forward for a whole train of cattle diseases.

I gave the amount of nitrogen or in other terms ammonia, that occurred in cattle dung, but planters must not run away with the idea that it is the vital part. I put it in such form as cultivators are accustomed to look for it. It is not the nitrogen or its successor ammonia that has the lasting effect which farmyard manure gives, but the varied mixture of incombustible ingredients.

I am rather inclined to think that too free a use of nitrogenous manures may have something to do with the leaf-disease. It seems to be need ful at the present day to add something of this sort to mixed manures or they cannot be sold. I do not wish it to be understood that no value is to be attributed to such, but it is small compared with other portions. These bulky and decomposable manures play a very important part in causing the ground to be opened, and to keep it open by their decomposition.

If all countries intend employing the quantity of nitrogenous matter or ammonia, as is done in England, where can we find a supply? Another most valuable manure is birds' droppings or *guano*—this term is applied to the more or less decomposed excrements of sea birds which

live upon fish, and have congregated for ages in myriads on many of the islands of the southern seas, and have formed immense deposits of their excrement, together with feathers and dead birds. These guanos are of two chief kinds, the one chiefly phosphatic, containing a small percentage of ammonia from ·5 to 1, but a high per centage of phosphates, often from sixty to seventy-five per cent., the other rich in nitrogenous matter. Both these guanos have a common origin, the one has lost its nitrogen, which has been converted into nitric acid and so washed out, leaving the phosphate behind, while the other has not been subjected to such wash, as for instance Peruvian Guano which has a good proportion of nitrogen as well as phosphate: this is due to the absence of rain in the country.

This manure is of too stimulating a nature to be useful for coffee: it is just the thing for giving vegetation a start at a certain period of its life, especially those plants which are short lived; its action is similar to a fly wheel in an engine, it carries the plant over certain dead or sluggish periods of its existence. Its affect also is short lived. It might be used for mixing with non-stimulating manures, but it is not good alone, neither would cattle dung were it collected and stored for long periods in the same manner.

We have yet another guano of very great value, but like the last, too strong to use alone, and that is from, *Bats*. Large quantities of such guano are found in Arkansas, Texas, Southern Spain, Jamaica, and several of the East Indian Islands. It consists of the dung and dead bodies of bats with earthy matter, and is found in caves which innumerable bats have frequented for ages. Some of these guanos contain up to ten per cent. of ammonia, and of phosphate of calcium from thirty to forty per cent.

A somewhat poor sample of bats' guano from Penang was analysed some short time ago, which analysis I now give.

Moisture	10 5
Organic matter	9·3
Phosphate of lime	38 0
Carbonate of lime	5·7
Sulphate of lime	13·8
Magnesia	0·7
Potash	6·0
Siliceous matter	16·0

The organic matter in this was equivalent to four per cent. of ammonia. This manure is much valued by planters in that locality. I have no doubt that caves occur in Ceylon which have been frequented by bats attracted by the great number of insects, for long periods of time and in which great quantities of valuable manure are stored. I think one region is called the Nitre Cave, here the dung from the bat has yielded nitric acid which uniting with the calcium, occurring in such caves has yielded nitrate of calcium. This like bird guano, might be advantageously mixed with others. We will next consider *poudrette* or human excrement, which is of great value and might be utilized to a much larger extent than is at present the case.

Poudrette as sold, however, contains a good proportion of useless and a very small quantity of excrementitious matter, often containing only three per cent. of phosphorus, and about the same of ammonia.

As far as poudrette is concerned, we might well take a lesson from the Chinese and Japanese who know nothing of the exhaustion of the soil, whose fields have yielded in abundance for thousands of years and this is accomplished by the use of poudrette. Human excrement there is highly valued. Every care is taken of it, it forms one of the chief articles of trade after grain and food. In Ceylon, excrement might be utilized to a great extent by the use of proper absorbents. The Chinese and Japanese have fully proved by their system that if the mineral matters are not restored to the soil, exhaustion must follow. The air supplies a portion of the combustible matters nitrogen and carbon to the soil, and the excrement which they return supplies the rest.

In Colombo alone if the same care were taken of excrementitious matters as is the case there, we should have an annual supply of manures containing 220 tons of phosphoric acid.

Another and exceedingly valuable manure of the animal class is bones, many tons of which are annually imported in various conditions.

The general composition of bone is

Water	6·2
Organic Matter	39·1
Calcium phosphate	48·8
Lime	2·6
Magnesia	·3
Sulphuric acid	2·7
Silica	·3

The organic matter being equivalent to 4·8 of ammonia.

Commercial bones vary very greatly; the Australian are preferred to the Indian, being richer in phosphate, and why is this? It is because the food of the animal here is less phosphatic than in Australia; and that it means the soil is not so, as many suppose. The soil here is not poor in phosphate, as has recently been stated, except in those districts where it has been removed in the shape of coffee berries for a long term of years without any return being made to the soil.

Analyses may say that phosphates are deficient, but on what grounds? probably on the analysis of the stem of a plant or tree. Can we expect such parts of plants to yield phosphates to any extent? Do phosphates enter into the composition of the hard tissues of plants as they do in animals? Can a man who knows the composition of plants, pass but briefly through most parts of this island and observe the natural vegetation, and say that Ceylon soil is singularly deficient in phosphates? I recently analysed for a planter the ash of a common estate weed and found its composition thus: it yielded 7·8 per cent of ash, and this ash contained 35 per cent. of potash and 8·5 per cent. phosphoric acid, and many other plants I have no doubt would show a fair proportion of these components.

Bones before being applied to the ground are subjected to various modes of treatment which affect their value.

They contain other valuable ingredients beyond phosphates. They are often boiled in order to extract the fatty matters which are utilized for soap making; this removal of fat accelerates the decay of the bone as such matter prevents the free access of air and moisture.

Boiled bones are the best for conversion into superphosphate, as the sulphuric acid with which they are treated acts upon the carbonaceous matter which surrounds the particles of bone and so prevents its full action.

Again after the removal of the fatty matter bones are often accumulated in heaps, whereby the decomposition of the nitrogenous matter they contain, great heat is developed; they soften considerably and can then be pulverized with greater ease; lastly they may be subjected to the action of superheated steam in order to extract glycerine and similar matters which are much used for stiffening various fabrics, the bones are however, still valuable on account of phosphates which are not removed by such processes.

To get the full effect from bones they should be pulverized well, without having undergone these boiling processes. The pulverizing may be greatly aided by steaming the bones provided care is taken not to allow various matters, resulting from such, to escape into the air, they can be absorbed by coffee dust, or the ashes resulting from the burning of chaff, &c.

Bones applied to the soil in such form contain the normal or tricalcic phosphate, an insoluble compound in water yet sufficiently soluble when in the soil for the purposes of the plant.

Superphosphates are well adapted for several rotation crops but not well suited for coffee, as they have too great a tendency to force the plant.

What is superphosphate is a question often asked. As I said before, the phosphates are somewhat difficult to understand. The normal phosphate of calcium as found in bones, is the tricalcic, it contains 3 atoms of calcium, this is the most insoluble form. By treating this with sulphuric acid two of the three atoms of calcium: unite with the acid to form sulphate of calcium or gypsum, while the two atoms so removed are replaced by hydrogen so forming a monocalcic phosphate, sometimes called biphosphate, a much more soluble form.

The manufacture of superphosphate is carried on in England to a very large extent; there are at present about a dozen firms who produce from 45 to 50,000 tons annually, as well as smaller firms making from 10 to 20,000 tons a year. The quantity of phosphatic material imported to supply the demand for artificial manures is about half a million tons annually.

Fish manure is one of great importance to the planter. It is one of the chief sources of phosphoric acid as well as of lime, various alkaline salts and nitrogenous matter. The hard parts of fish are similar in composition to the ordinary bones of commerce. Those of the bird hold the first place with respect to their richness in phosphoric acid. Next in order we have the bones of mammals, and then fish. The relative value of these are nearly in the same ratio as the numbers 16, 15 and 14. The softer parts of fish contain a considerable amount of phosphorous, which by slow oxidation is gradually converted into phosphoric acid, so increasing the value of fish manure as a whole. Fish manure is capable of being largely adulterated, if care is not excercised in the process of drying, and making ready for exportation. It is usually dried on the sand, and a great quantity of this adheres to the fish during this process. In some cases the bodies of the fish are crammed with sand—and in order to ensure a large amount adhering to it, the drying grounds when they have become caked and firm are broken up. Of fish manures at present imported Massey's patent appears to contain a minimum of sand: *viz.*, under 10 per cent.

In some manures this adulterant has reached 50 per cent.

Other animal substances such as refuse from the manufacture of meat extract in Australia, carcases of dead animals, blood, hair, &c., are occasionally used for manure chiefly composted with earthy matter, in order to retain the gases of decomposition.

VEGETABLE MANURES.—Green manuring as applied in England is inadmissable here, since the crop is permanent, it is done, however, in a certain sense as when the weeds around the trees are buried in holes or trenches: with a soil to a good depth and friable it would be better to return them in the form of compost.

The pulp of the coffee although considered by some, not to be of much value, should be returned to the soil, as its elements will always furnish material for fresh supply. The matter of which it is composed is not woody fibre, and therefore soon decays: it also contains a great quantity of sacchhrine matter which is valuable as a source of carbon.

POONAC or Oakes of various descriptions, in a pulverised or crushed condition, have a very beneficial influence on the soil. The are composed of seeds of various kinds, *minus* the oil that has been more or less extracted from them. They all contain valuable ash constituents, as well as nitrogenous and carbonaceous matter.

These cakes resulting from the seeds of various botanical families having different habits of growth and requiring different substances for the formation of their seeds, are of various relative value.

It is difficult to give them in order as valuable for manurial purposes since they vary considerably, however, it would generally be as follows: China bean cake would take the first place, followed by decorticated cotton, rape, gingelly, linseed, black castor, cocoanut and dombo.

The ash of some of these cakes contains over 1½ per cent of potash, and about 5 per cent of phosphate of calcium.

The nitrogenous matters of some are slightly soluble, but become more so, by decomposition, and are then more readily diffused through the soil than those from many other manures, consequently, it is not long before their effect is evident. Their chief action is the formation of wood and foliage.

MINERAL MANURES.—Of these, we have a great number, each capable of doing its particular work for the soil, or for the plant. One of the chief of these, is *lime*. It occurs naturally in Ceylon, mostly as carbonate, and is found in great quantity in the northern part of the island. Along the coast, as coral and shells (shells especially on the pearl banks, where great accumulations have taken place, and which might well be utilized) and in the interior as masses of crystalline dolomitic limestone of a mottled grey appearance, sometimes nearly white. One specimen which I have analysed contained 70 per cent. of carbonate of lime, and 15 of carbonate of magnesia.

Carbonate of lime is useful to most plants, since it is readily soluble in rain water. It would be best applied in the form of ground coral, for the crystalline limestone and shells would not be so easily crushed.

It is of great value on stiff heavy soils, acting mechanically, as well as chemically, on the latent stores of food in the soil, liberating the alkalies.

Lime is essential for the healthy growth of agricultural produce, without it, many crops are subject to diseases, and roots sometimes fail altogether even if they have been liberally manured with cattle dung.

Its presence has a great influence on the change which soluble phosphates or manures containing these, undergo in contact with the soil, On all soils deficent in lime, manures rich in soluble phosphate do not produce such a beneficial effect as upon soil containing even a small proportion of lime.

Lime is often applied not in the form of carbonate, but as an oxide. The oxide is readily prepared by subjecting any of the various forms of carbonate to the action of heat in a kiln, driving away the carbonic acid gas into the air not to be lost, but to return again in some form or other, it may be to harden the mortar with which we build our houses.

For building purposes we burn the carbonate, reduce it to oxide, mix with water and sand then place between the bricks of cabook or stone for what? To take back a similar amount of carbonic acid gas as was driven from it by burning in order to harden it, and this gas it obtains from the air. In the same way the burnt lime applied to the soil or to the compost heap will rapidly take up moisture and after that carbonic acid returning to its original form, but in a more finely divided state. In its burnt state it is highly caustic and well suited for decomposition of vegetable matter hence its suitability in a boggy or sour soil, Its great work is to aid the plant in obtaining its food by its mechanical and chemical properties. Lime may also be applied in other forms—for example, we may employ the sulphate commonly called gypsum, such is not found in quantity in the island, and its use will therefore be limited until we have a sulphuric acid manufactory.

This compound of lime is of great value for fixing ammonia resulting from decomposition of various manures, as well as for promoting the distribution of the alkalies in the soil. It occurs in all superphosphates being one of the by-products in its manufacture which is not separated.

We have also gas lime of a very caustic nature suitable for keeping weeds in check, and for aiding decomposition.

In addition to lime it contains various impurities of coal gas, such as sulphur compounds and hydro-carbons. The quantity obtainable is however, very limited.

Mineral phosphate of lime as coprolites which are the fossil excrements of the great reptiles of former ages, occur in some of the geological formations in various parts of the world, large quantities of these are subjected to the action of sulphuric acid, and converted into mineral superphosphate which is almost on a par with that derived from bones, as far as phosphate is concerned.

The general percentage of phosphoric acid in English coprolities is 56 per cent. Sombrero phosohate occurs in the island of that name in the West Indies, and is valuable as a source of mineral phosphate of time. The island appears to be composed of this earthy matter, it is thought to be fossil guano.

ALKALINE SALTS.—Potash is a very important element for coffee, but the soil here is generally very rich in that element containing almost an inexhaustible supply, provided the soil is cultivated to a good depth so as to admit of the latent potash now in the form of silicate to be decomposed, but where such is not the case it will be advisible to return potash in the form of manure, but not of such a stimulating character, as some of the potash salts, for example the nitrates.

There is a valuable combination of alkaline salts which has already found its way to Ceylon, the kainite and strassfurth crude potash salts obtained from Germany. These are used with much advantage in compost heaps to accelerate decomposition and fix volatile matters.

The composition of this salt as analysed by Dr. Voelcker, is :—

Moisture, loss at 212° F.	3·36
Water of combination	10·88
Potassium sulphate	24·48
Calcium sulphate	2·72
Magnesium sulphate	13·22
Magnesium chloride	14·38
Sodium chloride	30·35
Insoluble siliceous matter	·71

The sulphate and chloride of ammonia are salts useful for mixing with other manures, they are too forcing to be used alone, they render the earthy phosphates soluble, Common salt has a similar property.

Wood ashes are valuable as a source of alkaline matters, more especially potash which they yield in the form of chloride and carbonate. They are of greater value if the wood, &c., has not been fully burnt, leaving a quantity of charcoal useful for absorbing gases. Ashes should always be mixed with earth in order to prevent the waste of alkaline matter by wash.

Composts may be of all kinds according to the varying ideas of the planter. All animal and vegetable matters should be utilized in this way, different substances may be applied to the heap as ashes, cattle dung or other refuse to form a general manure. He must guard against adding burnt lime to substances rich in ammonia. In conclusion, I may remind the planter that the great components of his manures should be *phosphoric* acid, *potash* and *nitrogen*. These are what he has to obtain in order to feed his plants that they may make a fair return for the labour bestowed upon them. He may purchase these separately, and form his own special manure, or he may buy them already mixed, taking care that the value is regulated by the quantity of essential ingredients at a certain price per unit.

TOBACCO.

TOBACCO CULTIVATION.

(From the Madras Athenæum.)

WE want educated young men to cultivate tobacco. Good American seeds can be obtained from the Sydapet Farm and if ten acres of land were cultivated with tobacco, we are sure that the profits accruing from those ten acres will be considerably larger than the monthly salaries of clerks in public offices. Mr. E. Buck, Director of Agriculture in the North-West Provinces, says that an acre of land properly cultivated with tobacco yields a profit of Rs. 167.

An acre of land if properly cultivated will yield 800 lbs. of tobacco. In Maryland the average yield is 1,000 lbs. According to Warden "a hogshead weighing 1,350 lbs. is considered a good crop. On the fresh rich lands of Kentucky, from 1,000 to

1,500 lbs. are raised per acre." We see from this that an acre of land may produce more than 800 lbs.; but we think we are safe if we take 800 lbs. as the average produce for an acre. Mr. Buck too adopts this calculation. The price of one lb. in the English Market is *5d.* The following figures indicate, according to Mr. Buck's calculation, the profits which may be derived from the cultivation with tobacco of ten acres of land.

10 acres at 800 lbs. an acre.

For cultivation at Rs. 4 per maund of 80 lbs.	... Rs.	400
For curing at " 5 " " " 80 "	... "	500
For export at 8 pice a lb. about ...	... "	330
Profit	... "	430
Total 10 × 800 × *5d.*	... Rs.	1,660

It will thus be seen from the above, that if an educated man took some ten acres of land fit for tobacco cultivation, (and we are sure that the nature of the soil in Southern India is suitable for tobacco cultivation) and cultivated the same properly, he will get a profit of Rs. 430 or more than Rs. 35 a month, besides the profit that will accrue to him by the sale of the second growth plants which spring up after the first cutting, and which yield on an average, about 5 maunds or 400 lbs. an acre. It is thus clear that the proper cultivation of ten acres of land with tobacco, will give the cultivator about Rs. 45 a month; and this Rs. 45 a month, in an independent line, is immensely superior to Rs. 20 or Rs. 25 a month in a public office. Let the educated men of this Presidency consider our suggestion and see if it is not one that ought to engage their attention. Many suggestions of a similar nature could be made, but for the present we shall rest satisfied with this one. A word in conclusion with regard to the saving of tobacco seed. This is done by attention being paid to the following direction:—"Allow a few of the strongest plants to produce their flowers; they will have a fine appearance in July and August, and in favourable season each plant will ripen as much seed in September as will sow a quarter of an acre."

On the same subject the *Rangoon Weekly Review* has the following remarks:—It is estimated the outturn in good tobacco leaf from a properly cultivated acre of land ought not to be less than 800 lbs. In America the average is reported to be usually 1,000 lbs. East Indian tobacco generally sells in London for *1d.* or *2d.*, and excellent varieties fetch about *5d.* per lb. The Myouk-toung tobacco is so favorably spoken of that we may with some safety expect the latter price for it. Then if the Government farm there consists of 200 acres (this was its proposed extent) 800 × 200 × 5=800,000*d.*, or Rs. 33,333 per acre or Rs. 2,777-12 per month. Not an unprofitable speculation. Native calculations, however, give 370 lbs. as the average yield of an acre under tobacco cultivation. The calculations then would be 370 × 200 × 5=370,000*d.*, or Rs. 15,417 per acre or about Rs. 1,285 per month, even this is not bad. It is probable however, that the native growth would not fetch so much as *5d.* per lb. But in the Government farm at Ghazipore, and in Bengal farms, 800 lbs. have been readily obtained, and there is no reason why the superior soil and situation of Myouk-toung should not yield as much under proper care and scientific cultivation.

II.

It is with pleasure we notice the local administration persevere in the matter of improving the cultivation and curing of tobacco if the country is to advance more its natural products must be attended to in greater degree than has been the case; and of all vegetable productions there is none which the country promises to succeed so well in as tobacco. The plant grows in all parts—on the *churs* created by the rivers, as well as on the hills. In Northern Arakan it is found in the same district both on high lands and low lands, and all over the province this is the case. As far as quality is concerned, the best experts have pronounced it to be equal to any of the American grown, Manilla or Havanna kinds. The Kyouk-kyee tobacco is admirably suited for the manufacture of Cavandish or plug-tobacco.

It wil be within the memory of most readers that about 1876 the local Government made a decided move in this direction. The services of the late Dr. E. Brown were obtained on loan from the Government of Bengal, and the worthy doctor, leaving Ulya in the latter end of 1875, landed here in the early part of 1876. He was then despatched to Thayetmyo, Shwegyeen and Arakan. It is a pity his tour of inspection and report was not better planned; for the time was so ill chosen that wherever he went he could do little better than analyse soils, and report on growing crops. The country thus lost practical demonstration from an experienced person of how to effect the proper cure of the leaf. In Thayetmyo he was too early—the plants were growing and would not be fit to cut for months. So it was in Shwegyeen. In Arakan, if we mistake not, he was also too late. Had he been sent to the place put down last, first, results would, in all probability have been different. But, however much it is to be regretted no practical lessons in curing were given to the people, it will always be matter for congratulation, such an officer's services were secured, for now the capacity of the province for growing the plant has been established beyond doubt.

Tobacco growing and cure differ in districts owing not so much to difference in soil and climate as to local habit and prejudice. In one place the plant may be seen on low-lands which the river-floods have left and where the trouble for preparing the land is least; in another more care is taken in this direction. In some parts the leaf is shed green and dried, producing a strong tobacco, as on the Shan hills of Kyouk-kyee; in another the entire plant is strung up to dry over the kitchen, the produce being a mild flavored one. But the soil in most districts is rich and suited to the plant, that on the Arakan Hills producing the best kinds grown. The leaf from Sandoway, Cheduba Ramree, however, is small and woody and ill-suited either for export or the local manufacture of cigars. What the people require instruction in is to grow the plant properly and so cure the leaf as to develop the proper aroma. As at present carried out the cultivation is indolently and carelessly done. When seed-sowing is done the natives fancy all that is necessary is over, and no care is given to see the plants mature. In some places tobacco is grown with paddy, and when the sickle is put to the latter, the former is plucked up, taken home, hung up to dry, and consumed as required. The soil and climate are so favorable that almost invariably a good crop is secured. In the eastern parts the taking up of the crop is done before the rains, the hottest season of the year, it is therefore not to be wondered the drying ruins the leaf. The natives need to be taught to grow the plant *through the rains on the high lands*, and cure the leaf during the comparatively moist months of November, December and January, and, whomever the Government may appoint, it is to be hoped his attention will not be confined to work only within the fence of the Myouk-toung farm.

Myouk-toung itself is the best place for growing tobacco, and therefore the best situation for a farm such as the Government has. It enjoys special advantages, being close to the embrouchure of the Pee and Mee rivers, confluents of the Koladan. Labour is available from a Shan colony at hand, the soil is rich, and the climate all that can be desired. Carriage to Akyab, from which the place is distant about 71 miles, is easy on account of the river, and the prospects are the Government farm here will, if properly managed, open out a source of revenue and most likely one of wealth and prosperity to the country. The main object of this institution ought to be the imparting of a knowledge of cultivation and curing. To do this effectually natives willing to learn should be admitted as farm-hands; any native wishing to become acquainted with the methods pursued should also be informed; and the place thrown open to *bonâ fide* cultivators and tobacco-growers at all times. There is no reason why the place should not become a centre for the radiation of better ideas and improved methods of cultivation, and on appointing a Superintendent, it is to be hoped this improtant point will be prominently brought forward and impressed. The time, however, is short, for if anything appreciable is to be done, it must be done by July the latest.—*Rangoon Paper.*

CINCHONA.

The alarmingly increasing rate at which the cinchona trees of Peru are being rapidly exterminated has at last led the Government of the Republic to take legislative measures for the suppression of the evil. Gathering the bark will be permitted as heretofore in all departments of the Republic, except only in the Sandia and Tambopata valleys of the province of Sandia, where the *Cinchona lancefolia*, from which the so-called "calisaya" quinine is obtained, chiefly grows. But felling the trees is absolutely prohibited throughout the whole country, and the bark-stripping is henceforth to be conducted only under certain stringent conditions as to manner and time. To guard against possible contingencies, it is ordered that, in case of need, the Prefect of Purio, in which department the above-named valleys are situated, is authorized to place them under military control.

CINCHONA CULTURE: HOW TO SAVE THE LABOUR AND EXPENSE OF "PRICKING OUT" SEEDLINGS.

MR. HENRY POET writes from Rambodа to the *Ceylon Observer*:—Ever since I had anything to do with cinchona, it has struck me that the system in vogue for rearing plants is at fault. I have an idea, and that idea I will, with your permission, ventilate through my old friend the *Observer*. The usual course adopted, as you are aware, is to plant seed broadcast in covered beds, and afterwards, when the young seedlings have attained a certain size, to "prick them out" into beds which are also covered. This method entails a heavy expense.

Now what I am doing is this: I first make a quantity of beds, 3 feet broad and any length you like; these beds are divided from each other by drains 15 inches broad and 12 inches deep. The soil removed in the making of the drains is thrown on the centre of the beds and drawn down on either side so as to give the beds a "barrel." Over this I place a dressing of sand and mould ½ inch thick, in the proportion of 3 of mould to 1 of sand. Over this again I place a very fine dressing of sifted river sand: I mean the very finest small-grained sand you can procure. The object of this you will see anon.

The beds are now ready for receiving the seed. The manner of sowing is this—mix your seed with forty times its bulk of sifted earth. This part of the process is simple, but requires patience and accuracy. Take a tumblerful of the earth and place it in a box; on this put a tumblerful of seed, and thoroughly mix the two—then put into this another tumbler of earth and again mix intimately, and so on till you have 40 tumblers of earth thoroughly blended with the one of seed, continuing this process till you have all the seed you wish to plant so treated. This mixture of 40 to 1 of earth and seed is then to be *very thinly* scattered over the beds, and the thin coating of white sand will render it easy to see that this is evenly done. In my opinion if this be carefully done you will by this method do away entirely with the necessity for "pricking out," and thus save largely in time and outlay.

REPORT ON THE GOVERNMENT CINCHONA ENTERPRISE IN JAVA FOR THE 4TH QUARTER, 1878.

(*Translated for the Ceylon Observer.*)

THE weather during the past quarter was very favourable for operations. The rains began in the very first days of November, and have continued steadily since. In the last part of December strong winds did some damage, especially on the Nagrak and Kendeng Patuha establishments, where the buildings suffered much, and some hundreds of cinchonas were uprooted or broken.

Nine thousand nine hundred and ten days' work was performed by temporary hired labour. A great number of the plants in the nursery beds were able to be put out: they comprised 47,310 *ledgerianas*, 43,485 *officinalis*, and 21,550 *succirubras*. Their planting out was favoured by the most desirable weather, and the young plants are progressing exceeding well.

The gathering had to be discontinued at the beginning of November, when the rains commenced. Altogether there were gathered 121,343 Amsterdam pounds of bark, of which 112,321 Amsterdam pounds were reserved for exportation to Europe, whilst 9,022 Amsterdam pounds were kept for the use of the military medical department here.

The despatch went on very slowly during the last month, as the draught cattle, which are usually hired from the natives, are now required for working at the sawahs.

The distribution of *C. calisaya ledgeriana* seed has gone on steadily. The blossoming of the *ledgerianas* is beginning later than in the previous years, since scarcely any buds at present are visible. The seed will therefore also be ripe later, and in 1879 will probably not be ready for distribution before November and December.

The results of the chemical analyses are given in the annexed statement. The experiments with the partial stripping (mossing system) were continued, and from the analyses 161-175 it is clearly seen how the composition of the new formed *succirubra* bark differs from the original. The value of the bark is much greater, since by renewing the percentage of quinine is almost trebled. In the case of *succirubra* this is manifest; the renewed barks of other sorts were yet too young for a definite conclusion to be arrived at as to the change caused in them by the mossing system.

The original bark also, which has been a year under moss, improves by that means the amount of valuable alkaloids.

The analyses 71-76 deserve special attention. They are from 4-years-old *ledgeriana* seedlings. The plants which resemble the mother-tree least (75 and 76) had also a bark of inferior quality, whilst the bark of those which approached nearest to the type of the mother-tree showed a percentage of quinine which for such young plants is already very high. The chemical analyses will especially in this direction be proceeded with, in order to obtain as speedily as possible certainty with regard to the question, how far *ledgeriana* seed plants agree in yield of alkaloid with the mother-plants from which they are derived.

Registered No. 182.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA : THURSDAY, 1st MAY, 1879. [No. 5.

NOTICE.

The* Indian Agriculturist *will be supplied to all Schools and Missionaries in India at half price.

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

LETTERS TO THE EDITOR.

RIDLEY'S REAPING MACHINE.

Sir,—In the *Agriculturist* of October last, page 341, in a article headed "Wheat Cultivation in Madras and Australia," I find the following passage :—

"The expense of cultivation (in Australia) is small and the gathering in of the crop when it is fully ripe costs a mere trifle, *thanks to Ridley's Reaping Machine*, which reaps and thrashes the wheat by one simple process.

This machine merely clips off the ears of the wheat, and leaves the straw standing on the ground."

Would any of your readers kindly let me know where this Ridley's Reaping Machine is manufactured and sold,

S. DATTA.

Bishwanath.

Note.—Mr. H M Rogers (late B C. S.) 20, Corn Exchange Buildings, London, will furnish our correspondent with information on the subject.—Ed. *I. A.*

ELEVATING THE MAHAJAN.

Sir,—It is acknowledged that the low class of tillage so universal in India, is incapable of improvement with the amount of capital devoted to it. It is the maximum result obtainable from a minimum of expense. If we could induce capitalists to move money into agricultural works, there is no doubt that the return would justify the expense incurred. Thus with a stronger class of bullocks, an improved plough could be sent through the soil and new layers of mould brought to the surface. With small outlay improved water lifts might be made that would permit double the land being watered at no high cost. With a greater expenditure of manure, the same area of land would yield richer crops, and increase the surplus for export. Can we bring these facts home to the village sowcar, so as to induce him to lend capital to men who would devote it to these improvements? Here and there in the country we have experimental farms, where these innovations are adopted, but they are too few to effect much good. Yearly increased numbers of iron ploughs, and improved water lifts are being sent out from them to purchasers in different parts of the country, and in the district of Coimbatore the Double Mhote for raising water is fast superseding machines which though costing less in the first instance, are in the long run less effective. The desire for greater agricultural knowledge than can be obtained generally in the districts of India, is manifested by the number of applications for admission from a variety of classes and castes into the Technical Agricultural School at Sydapet—applications far in excess of the room and instruction available. We have in these examples, evidence that a desire exists for Agricultural knowledge with a view to improve India's future prosperity, and Government should use every endeavour to attract the attention of the monied classes, *more*, especially the village sowcars, to the subject.

F. E. H.

Bangalore.

THE PURCHASE OF COFFEE LANDS IN COORG.

Sir,—It will be interesting to the planting portion of your subscribers as well as a warning to intending purchasers of coffee lands *from Government* in Coorg to be informed of the following facts :—

In the month of September 1876 after some years of waiting and delay caused by the indolence and indifference of the Coorg Forest and Revenue Department, I became the purchaser at an auction sale under the waste land rules of the Theewar-betta jungle for Rs. 13,050 and which was stated in a specification published in the *Mysore and Coorg Gazette* to contain acres 185-16,

On the 4th of October following I also became the purchaser from the Coorg Government under the waste land rules of the Maymotti jungle adjoining the one I had just purchased and for this second purchase I paid the sum of Rs. 2,206 the land being represented by specification similarly published as the former to contain 20-10 acres.

I may here observe that my first purchase averaged Rs. 70-8-11 per acre, and my second Rs. 110-9-9 per acre, being some Rs. 40 and 80 more than has ever been paid in Coorg before or since for the purchase of land under the waste land rules.

In May 1878 and after incessant and urgent applications my managing superintendent (nearly two years after the sales) obtained from Government the survey plans, and upon an examination of them with the land, discovered that the area of my second purchase (the Maymotti jungle) was included in my first purchase (the Theewar-betta jungle) and that instead of my two purchases aggregating 205-26 acres as misrepresented to the public by Government, (I presume not wilfully) they only aggregated together 185-16 acres or the area of my first purchase.

By the date of this discovery myself and my partner (Mr. C. M. Grant) had expended on the cleaning and cultivation of the land with coffee and cinchona some Rs. 30,000 in excess of the amount paid to Government.

We not unnaturally concluded that we were entitled to a refund of the money paid by us for the second mistaken purchase, and I accordingly represented the matter to the superintendent of Coorg, and applied that the money namely Rs. 2,206, we had paid by mistake and which was at the same time conceded they had taken in equal good faith, should be returned to us.

As I happened to be on the spot at the time my personal representation was favourably enough received and the matter was at once referred to the 1st assistant superintendent of Revenue Survey, who with characteristic promptitude confirmed my statement that I had paid twice over for my Maymotti land or second purchase, or what was the same thing that officer reported that it had been surveyed twice over being already included in my first purchase, the Theewar-betta land.

We were then promised a refund of the amount improperly demanded and paid by mistake, but at the same time informed "*certain formalities*" would have to be gone through with the Accountant General at Bangalore. This occurred so far back as April last year, and although myself, my partner and our manager Mr. J. . Gerrard, have since been continually urging a speedy settlement it is only on the 17th of March instant, that we have received an intimation that "the Chief Commissioner regrets that he is unable to grant the refund *solicited*."

I will not trust myself to comment at any length upon the action of the Coorg Government (and I challenge a contradiction of the facts above stated) but I cannot forbear remarking upon the hardship to which myself and my partner are subject in being put to the expense, delay, and anxiety necessitated by probably prolonged legal proceedings in a remote *non-regulation* Province and in a Court where the presiding judge is the *head revenue officer* to recover (with what little hope of success you may imagine) money appropriated under circumstances that I am advised had our vendor been a *private individual* instead of a *Local Government* might properly have been made the subject of a criminal prosecution under the Indian Penal Code.

In conclusion for the present I may be permitted to remark that the foregoing will give your readers an opportunity of remarking what reliance is to be placed in the repeated asseverations of Government that they are wishful to foster the planting interest and invite the investment of European capital in India.

A. COOPER ABBS.

Madras, 26th March 1879.

KOTEGHUR NOTES.

SIR,—The weather during this month has been satisfactory We have had fine growing showers, and though there has been some hail, yet coming at this season it has done hardly any harm as the ears of the cereals are only just forming and where they have been injured there is still time for them to recover themselves or for new shoots to come out; the real danger from hail is when it comes during the months of April-May when the barley is just ready for harvesting, in which event the grain is knocked out of the ears and strewn on the ground to the loss of the cultivator, the wheat also then suffers, as although a month behind barley in the time of ripening, still it has then reached that stage when injury to it precludes any chance of its making fresh efforts at reproducing itself. The same remarks apply to the fruit blossoms. There is a heavy storm now raging, the hail is rattling on the roof, the wind is roaring round the house, the trees are groaning, the thunder is growling, and the lightening flashing, and altogether a very tolerable imitation of a cyclone is going on out of doors.

The following is a comparative table of the past five seasons :—

	1875.	1876	1877	1878	1879.
Snowy days ...	...	2.	1	...	8
Haily „ ...	...	...	8	1	4
Rainy „ ...	1	7	9	2	8
	Dry.	Seasonable weather.	Cold, vegetation retarded.	Mild and dry.	Fine, growing.

Wind in the early part North, then veered to N.-E., afterwards to S. When the wind is in the N. quarters it generally brings rain; I presume from the fact that, passing over the snowy range it displaces the hot air of the plains causing a vacuum, which, collecting the moisture floating about in the air causes condensation and the falling of the moisture as rain. There has been plenty of thunder and lightening, moderate in sound and intensity.

The thermometer (Fht.), hung in an open verandah, W. aspect is about 47° in the morning, 53° in the evening, lowest 39°, highest 64°.

The natives have a saying that if the weather has been dry up to the 14th February and continues dry all that day, that the winter will be a late one, and will be extended into the summer. It was dry on that day, and for about five months previously, and there appears every probability of the saying proving true this year.

The male cones of the keil (*Cedrus deodora*) are out; the chil (*Pinus longifolia*) and rai (*Pinus excelsa*) are putting forth their new leaves, the shegul (wild pear) is putting forth its leaves and coming into blossom the two operations being almost simultaneous; the Himalayan honey suckle (vern. *khunti, zbang*) poplar, bird-cherry and walnut are coming into leaf; the rhododendrons (vern. *bras*) both the pink-coloured and scarlet coloured ones are out in all their magnificence the cotinus-leaved viburnum (vern. *tus-tus*) is coming into leaf and flower, violets are out in great profusion, though only a few of them—the darker kinds, those growing in moist shady places—are scented; the village children gather large quantities of them and sell them to native dealers who boil them and convert them into a syrup which is reckoned cooling and is specially used in the hot weather: the juice of the leaves is an antidote for snake bite. then there is a sweet smelling flower resembling heliotrope, the corn-tulip (vern. *ghelu*) now abounds in the corn-fields, its pretty pink and white petals making a charming contrast to the green wheat. Weeds are coming up in great profusion, specially the dock (vern. *marela*) which is a special curse of the fields and requires constant digging out to keep it under. Dandelions are out in plenty, as also the buttercup.

The woodcock has left us and migrated to the plains; martins are now preparing their nests. minahs are plentiful. For true sportsmen this is the end of the season's shooting, as the birds are mating, building their nests, and arranging for the forthcoming hatching operations. Strange to say next month and until October the hills will swarm with cockney-sportsmen who will march about with extensive batteries, killing any and every bird (especially those sitting in their nests, as they are "such nice easy pot shots.") that comes within range of their bullets, while they make one quite nervous to see the reckless way in which they fire off their shooting irons; though the chief danger is (1) to themselves (2) to any one standing behind them. The native *Shikaries* make capital out of such people and lead—or rather mislead—them into all sorts of impossible places under pretence of "showing them a thing or two" in the shape of coveys of bird or herds of animals, which turn out to be so much moonshine—and expense for nothing: when found fault with the *shikaries* give the stereotyped answer "wonderful, never knew this place to fail me before always full last year *Harris Sahib*" (evidently a relative of Mrs. Harris) "killed enormous quantities here and was so pleased with me for bringing him here that he made me a handsome present" &c., &c., all of which our worthy cockney swallows and————s, I mean blesses, his own ill-luck. Spiders, lizards, fish-worms are out much earlier owing to the mildness of the season. Bees are swarming about the fruit blossoms in great numbers.

Food grains are slightly dearer than last month, as this is an opportunity not to be lost by our richer Zemindars, so many of whom are Government officials with power to abuse their position, especially when they are under the immediate protection of the Government European servant of the district: the poor are thus ground down under official sanction. Villagers are ploughing and preparing some of their fields to sow upland-rice, millets (vern. *koda* and *kâoni*), a species of dâll called *bharrd*, and hill-potatoes (vern *gwian, pahari âlu*) our pedigree, wheat was topped during the first week in the month and the green

stuff (mixed with hay) given to the cattle who liked it much; this week it is forming new ears and in no way behind the hill wheat, growing in an adjacent field, which has not been topped.

Lentils (vern. *masúr*) are growing; the barley is well into ear; the wheat ear is also forming—the crop will be less than in former years but there will be ample to enable the cultivators to tide over until the autumn crops are reaped. Where the ground has been well and continuously manured the crops are flourishing and will yield a full return. To show how great has been the drought of the past winter I may mention that where wheat was sown late (December) last year, it has only *now* commenced to sprout, *i.e.*, after the snow that fell at the beginning of the month. The new grass is sprouting and looking delightfully green. Clover is coming into flower.

Of fruit trees there are the apricot with its red and white petals: the peach with its pink petals: the cherry and quince with their white blossoms: the apple (about a month late this year) with its delicate pink and white blossom almost as charming as a young maiden's cheeks; this year will not be a good one for apples which only come in plenty every other year; last year being a bumper season, this year will give us less, and the vine, which is just bursting into leaf.

In gardening matters all kinds of flower seeds are now being sown: pinks, the tulip crocus, and other perennials transplanted. Onions transplanted, potatoes, peas, &c., sown. Paths are being put into repair.

Koteghur,
31st March 1879.

G. P. P.

TUBE WELLS.

(*To the Editor of the "Darjeeling News."*)

SIR,—In several of your recent publications I have noticed a correspondent of your paper speaking in praiseworthy terms of the Tube Wells, but I cannot say that I thoroughly comprehend or that I understand the particular description to which he alludes. Tube Wells are no doubt beneficial in certain soils, but why your correspondent should indiscriminately recommend them as generally suited to any and every locality seems to me suspicious, inasmuch as we know from only so far back as the Abyssinian campaign that they commenced well but ended badly; if a fair conclusion is deducible from the results obtained at Zoulla Bay and subsequently further into the interior, where rocky soil was met with; when the Tubes signally failed and the Government, notwithstanding the laudable efforts on their early successes, considered it advisable to provide for a possible emergency, consequently had other resources to fall back upon, fortunately for the Army, otherwise the disastrous effects consequent on the army reaching the interior, and rocky soil, might have been a terrible check to an otherwise triumphant force. Norton's Tube Wells are doubtless good but are not equal to indiscriminate application any where and everywhere.

The Tube Wells may be likened unto the Artesian Wells, which are applicable only to localities with natural springs and to be used when such localities suit in spring and soil. It must not be thought however that I do not speak without experience of these wells and that I am not aware of exactly their capabilities. In admitting that they might be used with good results in perhaps 10 *per centum* of the gardens about the district—and this ratio is what to me seems the outside allowance—in and about the Terai there is certainly a probability of their being used pretty extensively, provided planters did not see in them more of a toy than a practical and serviceable engine, that would answer fully the requirements of the ordinary well or spring. Of course it's all very well supplying the coolies with pure water for drinking purposes, but if there were any number of wells in and around a plantation, the great unwashed would prefer to visit the *jhora* where his thirst for water would be satiated in spite of all the planter's warnings as also his appetite for a little wholesome flirtation with *kanchee* allowing that the wells—as it would be natural to suppose—were only placed within such limits as would tend to keep them from injury say in and about the coolie lines.

LIEF.

THE STERILITY OF INDIAN FIELDS.

(*To the Editor of the "Times of India."*)

SIR,—Your correspondent, "E. V. S.," in your issue of 1st March contributes a very interesting letter on the want of that sort of practical agricultural instruction which can be so beneficially imparted to the cultivator by revenue officers of every grade in their periodical progress through their districts. No doubt, the executive revenue officers of districts are in a position to suggest to the ryot many counteracting measures to prevent the growing sterility of our fields, and to enable him to render to Government the regulated tax on his produce without impoverishing himself in the attempt. Your correspondent's letter, at the same time, furnishes a good example of the indifference of all mere theorists and system-makers to the practical difficulties to be encountered in carrying out their suggestions and remedial measures. It is an instructive circumstance that no specialist or amateur has confidence in any but his own panacea for the ills of this world. "E. V. S." expresses his opinion that the true methods of profitable agriculture are (1) deep ploughing, (2) the application of manure to stimulate the soil and (3) close and incessant attention to the operations of the field, in all which, says "E. V. S.," the Indian cultivator is deficient.

As to deep ploughing, your correspondent thinks, no doubt, there are stores of fertilizing substances in the subsoil which are untouched by the superficial action of the plough. He may be correct to a certain extent, but the utility of deep ploughing has not been so decisively ascertained as is perhaps generally supposed. In the first place, we cannot be sure if the action of the sun and air would be beneficial to plants in proportion to the depth attained by their roots, if it would not be positively harmful beyond a certain depth. It would be altogether fallacious to argue that because the action of these life-giving agents is beneficial to plants to a certain depth, that therefore it would be beneficial to them to any depth. As Burke observes in one of his excellent letters, it is as unsafe a way of reasoning in physics, as it is in morals, that because a given proportion of a good thing is advantageous, that therefore the double of it will be twice as advantageous, or that it would be advantageous at all to any degree. In the same letter, written, I may mention, to Arthur Young, the distinguished promoter of agricultural science in the last century, he mentions another practical objection to deep ploughing entertained by farmers:—"The minerals, in general seem unpropitious to vegetation. Some clays seem to be of the same noxious quality, and this, if true, makes an exception to deep ploughing upon bottoms mixed with such substances, supposing the principle of deep-ploughing to be otherwise generally sound. Under this head comes the general objection of farmers against ploughing up the dead earth, or going beyond what is called the staple; that is that body of dark-coloured mould which seems to be in part formed of rotten vegetable and animal substances. All these are doubts and questions not to be passed over lightly, especially the last, because it comes from men of much experience and is not a local objection, from a particular nature of a certain substratum, but supposes an universal inaptitude in all soils, beyond a certain depth, for the purposes of vegetation." The Indian ryot, I believe, entertains the same objection to deep ploughing. Whether he is right or wrong, is a question to be decided by scientific experts on ascertained data. But to assume as an established fact in agricultural science that deep-ploughing is essential to the proper nourishment of plants, and then to reproach the ryot that his mode of ploughing is but a mere scratching of the ground, scarcely denotes a thoughtful or dispassionate mind.

As to the use of manures as stimulants of the soil, no doubt "E. V. S." gives very sensible advice. It is very good of him to advise the ryot to conserve refuse matter and utilize human fertilizers: but what does he know of the resources of the ryot in this respect? The indigenous and local manure in a village is scarcely ever sufficient in quantity for the requirements of the fields. The application of manure to any soil is, of course, intended to restore the exact quantity of inorganic substances withdrawn from that soil on each occasion. That can only be done when the produce of the village fields is entirely consumed in the village by man and animal, and the refuse of the food thus consumed by man and animal is returned to the soil in the shape of manure. As, however, there is not a village in India which does not export some portion of its produce, a large portion of the inorganic substances is thus permanently withdrawn from the soil without being ever returned to it. The cultivator must, therefore, import artificial manure to make up the quantities of fertilizing substances withdrawn from the soil. But that is a question entirely of money, and if he is unable to buy manure for his fields, that is no reason why he should be charged with being "lazy" or indifferent to his interest. The sterility of Indian fields is owing, not because the ryot does not apply manure to his soil, but because he does not possess the means to apply it in quantities sufficient to ensure the successful cultivation of his food-plants. Other countries are able to keep up the fertility of their soil because their peasantry are rich enough to supplement their own manurial resources by artificial manure imported from other places. It has been too much the fashion to represent the Indian cultivator as something of a grown-up child who is utterly incapable of minding his own interest, so much so that the manure which to him is more valuable than gold, and which is supposed to lie about and rot at his very doors, is allowed to poison his air out of sheer laziness, without being utilized for purposes of profitable agriculture, while the fact is he uses as much manure as he can obtain or conserve with all possible diligence. He is aware his soil is yearly deteriorating, and he is aware, too, that more abundant manure would restore its fertility.

"E. V. S.'s" third count against the ryot—that he *is not sufficiently attentive to his work, and is wanting in energy and application*—may be dismissed in a few words. "E. V. S." alleges no proof, worth the name, in support of his assertion, except personal knowledge of the fact. However extensive that personal knowledge may be, and however it may have been acquired, against it may be set off the experience and knowledge of our revenue servants, of those who possess an intimate acquaintance with the ways and habits of the Indian cultivator. There is no peasant in the world who works for the bare necessaries of life so incessantly, and, withal, with such cheerful resignation to his lot. With a staunch belief in a relentless fatalism, the ryot works early and late to earn that little which is left to him after the Government have rack-rented him, and the sowcar has plundered him. And be it remembered, that in spite of his hard lot in life, he rises superior to the miseries of his condition, is a loyal and contented subject, living in peace with his neighbours, and kind to the very bullock or ox that helps him to till his field.

In conclusion, I might mention that the tenor of my remarks is intended to show what *I myself* am *fully* convinced of—that under present circumstances there are no ameliorating measures the ryot can adopt which can increase, to any appreciable degree, the yield of his fields. Here and there, by costly and special appliances, the yield of Indian fields might show some perceptible increase; but, as a rule, not one of those numerous remedies so glibly suggested to counteract the sterility of Indian fields, is capable of stimulating produce to any extent. You ask the ryot to employ good seed, to use abundant manure, and to rear a better breed of cattle; but you do not reflect that neither good seed, nor abundant manure, nor a better breed of cattle, are to be obtained without money—a commodity rather scarce with the ryot. Thus it is that while population is constantly and rapidly increasing, the food-producing capacity of the soil is as certainly deteriorating, aggravating year by year the distressing condition of the cultivating classes throughout India.

P. P. T.

5th March.

TUSSER SILK FILATURE.

(*To the Editor of the "Englishman."*)

SIR,—In your paper of the 19th current, you give credit to Captain Coussmaker for having first brought the tusser cocoon to the notice of the Government, or words to that effect, and declare that he was worthy of receiving the "Grand prize medal," &c.

Without wishing by any means to take away from the praise due to Captain Coussmaker for the time and trouble he has bestowed on the tusser cocoon, I must point out to the public that what Captain Coussmaker has been attempting to do without success had already been done long before. I allude to the rearing of the tusser caterpillars in parts of India other than where it is indigenous, and the unreeling of tusser silk from the seed cocoons.

Captain Coussmaker appears to have attempted to rear worms on leaves not generally eaten by them, and of course he failed in rearing them. Had he only studied the worm first in its jungly home, he would have learnt what to feed them on; he apparently did not do this, and used a number of leaves that others told him to use, and f[illegible]led. No one up to this has taken the trouble to discuss the matter, and what he has placed on paper stands good. He gives a list in his report to the Government of thirteen different plants on which the worms have been fed, and there are only two out of the 13 that are really fed on by the tusser worm in its jungly state. In 1862 I happened to be employed in the Palamow district, and as I had just left a firm under whom I had seen a good deal of silk reeling, the tusser worms and cocoons naturally attracted my attention. I made experiments to unreel the cocoons, and after repeated failures, in 1864-65, I found out how to work them off. I then made some skeins of silk for a friend, who sent them off to England, where it was reported on and valued by Messrs. Durra[illegible]t and Co. Unfortunately for me, this friend left the country, and as I [illegible]ad my time fully occupied with other business, I dropped the tusser cocoons. In 1868-69, I addressed a letter to the Government of India giving information as to the tusser worm, &c., and asking the Government to assist me in utilising the tusser silk, and otherwise giving it a position in the European markets; but I never had a reply to this. In 1872, I again addressed a letter to the Government of India, Agriculture and Horticulture Department (to Mr. Secretary J. Geoghegan), setting forth all I knew about the tusser cocoons, stating that I could unreel the silk from them, and proposing a scheme to open out a tusser silk filature, offering too to supply land, free of cost, for erecting the filature upon, and asking for aid, till I could place the raw tusser silk on the European markets as a recognised article of export, after wh[illegible] [illegible] would find people to take it over from the Government. I heard in answer to this [illegible] consideration. Portions of it too (I came to hear from outsiders) were printed by the Government, and sent out for the opinions of the Commissioners of Divisions. Later on I got a further reply of a negative character.

About 1873 I again took service with my previous employers in the silk business. I then found a lot of tusser cocoons at the head-quarters of my manager that had been sent to him by the Chief Commissioner of the Central Provinces for experimenting on. No one knew the process of unreeling them, so I was asked to take them in hand. I made silk from them, that I sent to the Chief Commissioner. As however the cocoons were old and considerably damaged, I asked the Chief Commissioner, Central Provinces, to send me a fresh batch; this he did, and I reeled off some more silk for him. I then had communications from the Deputy Commissioner of Chanda, and the Assistant Commissioner of Hoshiarpur, regarding the tusser cocoons and silk, and I sent them some tusser silk. Afterwards, I wrote to the Chief Commissioner, Central Provinces, proposing to open out a tusser silk filature within his jurisdiction, if he would assist me with rent-free land for the works, and grant me certain other rights and privileges; also give me the sole monopoly of reeling silk from the tusser cocoon for a series of years. In answer to this I got the following:—

No. 3371.

From—Captain W. Vertue, Deputy Commissioner, Chanda,
To—J. Deveria, Esq.

Chanda, the 14th of October 1875.

SIR,—In continuation of previous correspondence, I beg to say that I duly forwarded your letter of 1st July for the information of the Chief Commissioner, Central Provinces.

I am directed to inform you that Mr. Morris thinks the Central Provinces are too backward to offer a field for the special knowledge you possess. Mr. Morris thinks that you might perhaps find it advantageous to put yourself in communication with the Government of India, Department of Agricultural, Revenue, and Commerce, and Captain Coussmaker.

I have, &c.,
(Sd.) W. VERTUE.

I then wrote to the *Indian Statesman* stating my specialité of reeling off tusser cocoons, and asking for Captain Coussmaker's address. This letter was replied to by Captain Coussmaker, to whom I sent three skeins of tusser silk reeled off by my process, as also specimens of coloured stuffs woven in the Bancoorah district from tusser silk. These specimens were all woven with fast-dyed tusser silk. I got thanked by Captain Coussmaker for the silk I sent him. He wrote to me,—"the three skeins are the very best I have ever seen; beautifully clean, bright, glossy, and even; perfectly free from smell, and if our cocoons can be worked up like that, they must be well worth collecting." So you see, the tusser cocoons were unreeled by me in the ordinary filatures, long before it was done in Italy, and Capt. Coussmaker has brought nothing new to bear on the tusser silk question. I guarantee to make as fine silk from the tusser cocoons, as any of the Italian or French reelers. And more, my silk will have the gum on them, necessary to ensure a firm and even thread which the continental silk does not possess. Another point too is, that the silk reeled off the tusser cocoons in Europe is puffy, and from want of gum the thread unravels and shews all its fibres, very much after the appearance of the "floss" silk that is used for carpet work and embroidery purposes, and the question is whether the trade will accept of such a class of silk. If silk of this description were unreeled from the ordinary silk cocoons and sent to market, it would probably turn out unsaleable. I have found that the tusser cocoon cannot only be unreeled in filatures like the ordinary silk cocoons (with the aid of solvents), but more, they can be worked up into stuff very like cardboard, and if after the cardboard is passed and dry it had given back to it the albumen and tannin, which it lost in manipulating, the cardboard or "block silk" as I call it, resumes the peculiar hard leathery texture it originally had; I am disposed to conclude that such prepared block silk will eventually supersede gutta percha and caoutchouc (Indian rubber) to a good extent because the substance appears to me to be a non-conductor of heat and not susceptible to lose its elasticity. I have, however, not been able to carry out any extensive experiments with this prepared material. It would, however, be of the utmost importance to science and art that the properties of "block silk" should be tested, and its capabilities experimented upon. The Government ought to be able to undertake this investigation. If necessary, I will explain to the Government officials how to manufacture the "block silk" I allude to; and if required I will supply eight to nine maunds of tusser cocoons at prime cost, to carry on the experiments with. The Government somehow make no mention of my previous communications regarding the unreeling of the tusser cocoons, and Captain Coussmaker also does not, in his publications seen by me, make any mention of the specialité I have worked out. Be this as it may, there is a great deal [illegible] before the tusser [illegible] understood; and

it is to be hoped that the Government will spare no cost or trouble to do the needful in the matter.

In my previous communications, I submitted to the Government the necessity of procuring full information regarding the bleaching and dyeing of the tusser yarn, as practised in the various districts of Bengal. I also assisted in the matter to a small extent, but up to this I have never been able to learn what has been done, if anything, towards making public the information obtained on the subject.

Finally, in the papers published on the tusser cocoons (alluded to by you) there are a great many items that could be discussed, and erroneous reports corrected. Will the Government not ask Captain Coussmaker to give his aid towards the said discussions and corrections? I would like to see what he says on the reeling of cocoons at a temperature of 200 degrees.

J. DEVERIA.

FORESTS AND RAINFALL.

(To the Editor of the "Bombay Gazette.")

SIR,—I read in your journal of the 6th instant a very interesting article on "The Effect of Forests on Rainfall." After having given some data obtained on the Continent regarding this very important subject, you conclude by saying that the data obtained are of no use to prove that the forests cause *a greater amount* of rain to fall where it is most essentially needed, *viz.*, in surrounding cultivated lands, and that the searches made on the Continent have led to no *material results*, at least this is how I understand your argument. I perfectly agree with you on the first point, for I was not aware that it was ever intended to show that the benefits of forests extended as far as this. But as regards *material results*, the Continental forest authorities have arrived at very important results, and they are now laid down as absolute laws in the schools of forestry in Germany and France. I shall confine myself to only giving those which relate to the question of "Rainfall and Forests." Given a large tract of forest anywhere, its effect on the country around is—Firstly.—The same as a large tract of water. It moderates all climatic phenomena in the surrounding country, keeping the temperature more or less near to a mean. And in increasing the number of times (not neccessarily the amount) of the rainfalls in a twelve month. This last is nothing more or less than modifying a climatic phenomenon.

Secondly.—It increases the water supply of the neighbouring country.

Thirdly.—It stops the ravages caused by the rush of sudden and great floods of rain.

The consequence accruing from the first is naturally this. If in place of the ocean we had a forest our South-West monsoon would be but slightly altered; but if in the place of the ocean we had only cultivated or bare lands the effect would be certain death to the greater part of the community. This applies also to forests on a small scale. For when a hot wind blows across a forest, its air absorbs a great quantity of moisture from that forest, and by passing over several series of forests or one large forest, it gets more or less charged with moisture, and provided the source of obtaining moisture does not cease sooner or later, it condenses, in the form of rain, on that land over which it may be at the time when it is overcharged with moisture. Of course to lower essentially the temperature of a hot wind and to overcharge its air with moisture, the forest in question must not only be of large dimensions as regards area, or a continued series of tolerable sized forests, but each forest must be complete—that is, it must cover completely the ground on which it stands. Scrub forests and forests of poor growth are next to useless. But given the complete forest as above it acts like a sponge, always retaining moisture in the land and always giving it out little by little to exterior evaporating agents. Then, if we have in India a series of lines of complete forests on all the hills a large tracts of forests in the plains, when a strong hot wind blows, the consequence will be that this hot win dwill get a series of coolings and also will continually take up moisture. Now, if the wind continues to blow it will blow the water-charged air over the land lying between the series of forests. This land or the air immediately about it must get more or less cooled itself; and then will not the rain fall outside the forest? Where does the water come from that falls in the South-West Monsoons? Surely not from the land on which it falls.

On the other hand, if all the hills are bare or have merely scrub or grass, the hot dry wind blows and blows as long as it likes, evaporating at first any moisture that may be near the surface of the land, if the sun has left any, and then this air can never cool enough or obtain enough moisture to cause any rainfall. So dry wind succeeds dry wind, the earth gets parched to an immense extent. Later on when the real rain winds blow, the time the air takes to cool and its water to condense is in direct proportion with the heat that this soil contains or rather the amount of its power to stop condensation; and this heat is less in countries with forests than those without. Hence it is very easy to see the beneficial effects of forests here, *viz.*, of ensuring a rainfall as soon as the rain-charged clouds appear; or, in other words, forests, if present in a sufficient quantity, will ensure a regularity in the period that the monsoon should appear, besides keeping the land surrounding at a more moderate temperature. Who has not seen the clouds that pass over head for weeks before the monsoon commences? These clouds cannot condense because the land has to go through the cooling process, which takes longer and longer according as the amount of forest land is less.

This, then, is one of the effects of forests on the rainfall, and arises from the fact of forests being able to prevent the too rapid evaporation of rain, once fallen, by their regulating powers of respiration.

But forests resist, amongst many others, one great force, *viz.*, *gravity*, which tends to take away water too rapidly when once fallen, and its effects can proceed but slowly in presence of forests. On hills especially where forests exist, directly the rain has fallen it is held by the forest vegetable soil to an amazing extent, and gravity only carries it to lower levels by degrees, and thus we have permanent springs, rivulets, &c. On the other hand, when rain falls on a barren country or a hill side it nearly all runs off at once, carrying with it the soil as it cuts deep furrows and nullahs which increase every year in size. In fact, it devastates the country. This is, of course, impossible where there is a forest.

Of the water that falls in rain a small proportion sinks into the depths of the ground. This is bad enough; but what is worse follows. This rain is not followed, I will say, by any more, in fact, the hot weather commences Then the forces of gravity and evaporation have full play, and in a very short time the whole of the water has disappeared, never to be seen again for another year. I do not say that there are not permanent springs in countries without forests; but by what I have said before it will be clearly seen that the supply to existing springs will be more lasting. Springs and streams which last only a part of the year will become permanent, and many that only last but for a month or so will have their duration perhaps doubled. I cannot enter into a long explanation on the subject of springs, and what in particular places they form and in what places they will not. But of course such places there are and the theories may be known to all your readers. I would therefore, in conclusion, add that forests may cause latent springs to come again into action, but of course where springs never were since the geological formation of the land, forests here cannot be expected to make them. But they act beneficially otherwise in *moderating* and *regulating* climatic phenomena and *stopping* the *ravages of great floods of rain.* So that if the *Commission* now sitting in Bombay cannot arrive at any proofs as to the effects of forests on rainfall or on the direction of the winds (over which last, by-the-bye, they have none), it will always have enough grounds to go on to declare forests invaluable from the points of view that the Continental nations consider them beneficial, and will doubtless see how indirectly they affect famines.

FORESTS.

The Indian Agriculturist.

CALCUTTA, MAY 1, 1879.

HOW PLANTS ARE FED.

THE life of a plant, like that of an animal, is a mystery. No one can tell why it lives, or why it dies. We get no explanation of the real matter by saying that plants are propagated and die, in accordance with certain fixed laws. We are not one whit nearer the secret of existence even when we know many of the conditions under which *growth*, *nutrition*, and *propagation* are possible. In the case of man, "What am I, whence came I, whether am I tending"?—these three questions, which have formed the central magnet, round which the best thoughts of all the ages has gathered, are likely in all time coming, to be as fruitful in thought and speculation as in the old days.

How comes it, that a seed, a germ, cast into the earth, and buried out of sight should find there, those very conditions which are absolutely necessary for its life and growth? A plant may be said to have begun to live, when the heat and moisture of the earth have set up in the starchy substance of the seed, a chemical action by which this starchy matter is changed into sugar, and given up as food to the young *plumule* and rootlets. It is quite

true, that the seed could get heat and moisture without being buried in the ground; but it wants something more, if it is to come to maturity. All that the heat and moisture do for the seed at this stage is to make it possible that it may feed itself till the embryo plant sends out rootlets and little leaflets, down into the soil and up into the air to search for food in every direction, after the store has been exhausted with which every seed is naturally provided. After this has been expended in producing rootlet and *plumule*, after all the albumen stored up in the seed-leaves *(cotyledons)* and under its skin has been used up, the plant is then usually able to feed itself from the various sources from which plant food is obtained. These are the three following, the soil, air, water; plants do not directly feed on solids. Whatever mineral matter enters into the composition of plants and forms part of their tissues, is brought to them dissolved in water. No solid substance can enter a plant as food. All plants are formed of cells, little bags of nearly every shape and varying in size, within the walls of which are certain liquid and granular substances. The walls of these cells are composed of a substance called *cellulose*, they are extremely thin and often transparent, and the cell contents are albumen, a substance having much the same properties as white of egg, woody matter, starch, oil, sugar, gum, and colouring substances.

The cells of an orange are easily seen, as are those of other fruits; but cells are of every shape, round, oval flattened to a disc, few or many sided, produced by pressure, drawn out to a spindle shape, their walls touching, and sometimes broken away, forming short tubes and vessels of different sorts. Some are full of hard woody matter, others have a fine juice as their contents; some are nearly filled by spiral thread-like structures winding round their walls, others again contain colouring substances from which come the varied tints of stem, foliage and flower. These cells and tubes and vessels, whether they can be seen by the naked eye, or only under the microscope have no direct open passage from one to the other. Even the extreme ends of the little fibres of the root, called by the elder vegetable physiologists *spongioles*, have no opening, they are closed cells. Some people are under the impression, that the ends of roots are so many open mouths, leading into open tubes, through which food (sap) enters, and is carried over the plant, as blood is circulated by the veins and arteries over the body. Plants have no sap vessels no tubes with open ends sucking up nourishment. From tip to crown they are altogether cells, big, little, hard, soft, all shapes, serving various purposes in the economy of the plant, but all closed at either end. Whatever then, gets into a plant must be either liquid or gaseous. The question naturally arises, but if the cells are all closed, how can either air or water enter? That they do enter we know, and in the case of water we can see it enter; by placing the growing bulb of a young hyacinth in coloured water, the colouring matter is seen creeping up the long white fibres and ascending the roots. A plant then has the power of taking water in at its roots and sending it over the whole plant, and the only possible way it could gain an entrance is through the cell walls. This it does in accordance with a well known physical law called the law of *osmose* or impulse. Briefly stated, it is as follows:—All liquids of unequal density separated by a porous partition have a tendency to mix, and in this respect it resembles the law of the diffusion of gases. This law can be illustrated in many ways. Here is one: tie a piece of bladder to the end of a fine glass tube, and fill the bladder with treacle and water, placing it in a glass jar of water. In a short time you will see, round the bladder, the water getting discoloured and you may be sure the water is going through the bladder, for the treacle and water are rising in the tube. The same experiment may be performed with sugar and water, or with alcohol and water, or with any two liquids of different densities. This is precisely what takes place in the plant; outside the root there is always moisture, and during the rains, abundance of water. Suppose a cell at the extreme end of the root to be resting in water, a little of its contents will ooze out, as is the case with the treacle through the bladder, and be replaced by a larger quantity of water from without. This cell now contains a mixture of water and its original contents, constituting a liquid much less dense than that contained by the adjoining cells, to which it is attached. The same process is communicated from cell to cell. All plants have not the same *capacity* of imbibing liquids, some take in more, some less. A sun flower has been known to absorb thirty-four cubic inches in an hour. This of course is exceptional; but if we remember that this passage into each other of liquids of different densities is constantly going on in countless numbers of cells, we may readily believe that a plant will have no difficulty in supplying itself with abundance of water if it is to be had in the soil. It may be quite true that there may be no perceptible difference in the density of the sap after it gets up the plant a short distance, nevertheless there is a difference, *endosmoses* and *exosmoses* still go on, till the sap reaches a part of the plant where the swaying of the stalk and branches forces it higher, and the evaporation from the leaves carries off by exhalation part of the cell contents and so carries the sap up further.

IMPROVED PLOUGHS IN THE NORTH-WESTERN PROVINCES.

WE have for some time past heard little, officially or otherwise, of the operations of the Department of Agriculture and Commerce in the N.-W. P. Notices, however, have lately appeared in some of the local papers of the exhibition of implements at Bulandshahr and Aligarh, which have led us to make enquiries as to the progress which the Department has been making in the direction of improved ploughs. We remember publishing several months ago, a paper by Mr. Buck in which was drawn up a list of the "difficulties" which that officer conceived had to be overcome before an English plough could be offered to a native cultivator with any chance of his accepting it for *bona fide* use, the four most important conditions which had to be satisfied being the following:—

1. A reduction of the actual weight to such a point as to enable the cultivator to carry the plough on his shoulder with tolerable ease.
2. A reduction of the draught to within the capabilities of ordinary cultivators' bullocks.
3. A very considerable reduction of the price.
4. A simplicity of manufacture which would render possible repair or even construction by good native smiths or carpenters.

We have now obtained the following particulars with reference to the operations which have been going on under the Department since the publication of the note to which we have referred. In the first place it appears that a very large number of ploughs were brought over by the Department from America and England, and that at the same time Messrs. Ransome and Sims were personally consulted as to the possibility of modifying the native plough, of which a specimen had been sent to them. It appeared evident, however, that the principle on which the native plough is constructed is in itself vicious and that it is absolutely impossible to accept it as the basis of modification. The only course which remained therefore was to take one of the Foreign ploughs as the working model and introduce such modifications as could make it satisfy the required conditions. After trials of various ploughs it was found that the weight and draught were universally prohibitive, but it was at the same time decided that one of Messrs. Ransome and Sims lightest ploughs (the "B. F. O.") gave the best promise of success. A modified form of the plough was made in the bazaar, the price was reduced to Rs. 15, the work done by the plough was extremely good and any fairly good pair of bullocks could drag it with ease. But it was not light enough in actual weight; was not within the dragging powers of the lighter bullocks of the average cultivator, was somewhat complicated in make, and was still not low enough in price. Another model, (one of the American Eagle swing ploughs) was therefore substituted for the last described plough, which, of all the English patterns, had seemed the most likely to succeed, and is still to be greatly recommended where good bullocks are available. Experiments were conducted under the superintendence Mr. Fuller, Mr. Buck's assistant, who succeeded in introducing some effective modifications in the American plough now taken in hand as a model; the make of the plough was simple enough, and it was soon found possible to reduce the actual weight to within the required limits by a few immaterial alterations in pattern; the draught however was

still too great and some farther alterations had to be made in order to lessen the resisting force. Finally, samples of the plough were turned out in the Cawnpore Bazaar at various prices, between Rs. 8 and 10, which settled down to a contract price Rs. 8-8. The construction of the implement is extremely simple and the steel point which is the one part of the plough which is liable to more or less constant renewal is so riveted (on an American plan) as to be replaceable by any ordinary good *mistri*. The weight of the plough as now turned out is 18 seers, the average draught registered by the dynamometer about 1½ cwt., the price is (as above stated) Rs. 8-8 and the repairs or construction of the implement are within the powers of any ordinarily good native workmen. The average depth of the furrow is about 5 inches.

The condition of the problems which the department set itself to work out have therefore been apparently fulfilled so far as they have already been stated. But it has yet to be proved that the plough fulfils all the conditions required by native cultivators and that they will themselves adopt it and bring it into practical use. Even if (as seems likely) the plough can be used without real difficulty by the Indian ryot, yet the *vis inertiæ* which has to be overcome is so powerful that much remains to be done before any extensive introduction of the plough can be hoped for. The first step taken has been to bring it to public notice at the Fairs held in the Bulandshahr and Aligarh districts, in the former of which the fair has some claim to be called an Agricultural Show. Among the zemindars of these districts there is, as it happens, the most intelligent and zealous set of proprietors to be found in these provinces and the result of the exhibition of the plough at the above named fairs has been to interest these gentlemen thoroughly in the matter. But it is more satisfactory to note that a certain number of cultivators, and among them the man in whose field the experiments were tried, have expressed their practical approval of the ploughs by giving orders for them. The next step will be to try them on Court of Wards Estates, and it is expected that by the end of next ploughing season the verdict of the native cultivators may have been obtained.

The plough, as now modified, cannot be brought sufficiently close to the bullocks to enable the driver of the plough to reach his bullocks' tails; but when cattle are fairly trained it is quite possible for the ploughman to drive them himself, and as a matter of fact this is regularly done by one or two intelligent cultivators who have taken the ploughs, while both at Bulandshahr and Aligarh fairs, it was demonstrated even with untrained bullocks, that this was a matter of no great difficulty.

It is understood that the Department are still pursuing the study of the plough and that it is very possible that further modifications or new models may yet be adopted. But they consider that the results already reached sufficiently meet the required conditions to justify them in making a commencement in introducing an improved plough to the notice of native cultivators. Several official and native gentlemen have volunteered a request that ploughs may be sent to them, and there is no doubt that a practical and efficient trial will now be made in various parts of the provinces the results of which will be made known next year.

REAL PHILANTHROPY.

WE have heard of an enterprising advertiser, who "kept a poet on the premises," but to start a philanthropist must have been reserved for Messrs. Warner and Co., Agricultural Engineers of Cripplegate. Messrs Warner and Co., are much interested in the introduction of windmill pumps into India, as a simple means of raising water, and they base their interest in this matter not on sordid considerations of *L. S. D.* but on the more exalted principles of a pure philanthropy. Their spokesman is a gentleman of the name of Goslin, unfortunate in its suggestiveness, and he has lately "thrown off" several literary gems, which reach this country in company with illustrated catalogues of his patron's machinery. One of his productions circulated in this way is in the form of a letter to a correspondent, interested in windmill pumps, and, at the risk of detracting from its excellence as a whole, we cannot help quoting a sentence or two as studies in Syntax as well as in Indian Economy. It must not be imagined that Mr. Goslin writes inconsiderately, or without some sort of experience in Indian matters: "My attention was "directed to these (*i. e.* Indian) famines when quite a boy by an "uncle who lived in my father's house for some years, after having "spent a good portion of his earlier life in Madras, Bombay, and "Calcutta. The monsoons (the hot winds) and the want of "rice have been therefore facts before me as facts recorded, which "made a LASTING IMPRESSION upon my mind some 25 or more "years since." Mr. Goslin's ideas of the monsoons must be as droll as those of the author of "Chatty Letters from India" concerning the perfections of the Indian climate. But although the Famine Question seems to have, to some extent, engaged Mr. Goslin's attention since his earliest infancy, it was not till 1873 that his ideas took definite shape in communication with a Major Rogers, of whom he gratefully, but ungrammatically writes: "Major Rogers, who was a gentleman of great intelligence "and observation and who evidently had not only been in India "as one of the Bengal staff, but one, who, gifted with feeling "for the sufferings of Hindoos, tried his best to save them on "the one hand from the ravages of the wild animals, and on the "other from starvation (but whom (*sic*) as I gather with my "deep sorrow died soon after his return to India in 1875) and "had his mind much exercised as to the introduction of some "small but strong and simple windmills for pumping water "where as he said NOT ONLY were the Hindoos famishing but "also the bullocks which were used for raising the water, but "whose labour was inadequate to produce the desired effect "with them. I tried with him several experiments with "windmills of different models, motions, and constructions." The mind fails to follow this labyrinth of sentences, which indeed is scarcely paralleled by the famous nonsense story of Coleridge beginning "She went into the garden to cut a cabbage leaf to "make an apple-pie."

But, strangely enough, Messrs. Warner and Co. do not rest contented with the efforts of their "poet" and have added a pamphlet of their own, with the modest title "Famines and Droughts a Pressing Question Answered" We recommend this to the perusal of the Famine Commission, if it has not already received their attention Texts from the Bible, religious and moral reflections, statistics and pictures of the best things in pumps are interspersed with a slightly bewildering effect, and the reader is prepared for the suggestion, which is made in the last few pages.—That a society be started to provide the Hindoos with the wells they are too poor to make for themselves, to be worked by windmill pumps—which Messrs Warner and Co. will be happy to supply, *at moderate prices.*

THE SETTLEMENT AND THE BUNNIAH.

THE Bengal Rent Bill has excited more interest, in certain quarters, than the Affghan War. Some regard it as a wise measure calculated to prevent land from passing into the unhallowed grasp of the money-lender, and we were ourselves eager to welcome the provision which aimed at this. Others, of a less hopeful disposition, can see nothing in it, but Mrs. Partington's policy of keeping out the Atlantic by means of the humble domestic broom. And we fear there is force in the argument that, if the social and economical exigencies of the present time, whatever their origin may be, tend to induce the cultivator to raise money on his land, their operation will not be hindered by any regulation which professes merely to place restrictions upon them. Could one indeed discover why the tenant is unable to retain his ancient status, and why the man of money bags, in these days, is so invariably the master of the man of acres,—some tangible result might be expected. Either we should apply ourselves to enforce a remedy, or we should honestly acknowledge the evil to be past our skill. But merely to aim at preventing effects, while the cause is yet undiscovered, is a procedure which has been arraigned, and not unreasonably, as somewhat preposterous. It has been observed with concern that tenants enjoying rights of occupancy are prone to pawn those rights, or even to sell them outright. The

mortgagee or purchaser is of course the money-lender; and the consequence is that the land is passing from the hands of the yeomanry into the clutches of usurers who regard it merely as a profitable investment, and in whose eyes that estate is the best which will endure the most outrageous rack-renting. To meet this evil, a number of experienced men assemble in conclave, and decree that tenant-right shall be alienable only to persons who are really connected with the landed interest. The *boná fide* agriculturist, in short, is to take the place of the city money-lender, as the help of his brother peasant in distress. Unfortunately, there is not the remotest chance of his becoming capable of undertaking any such responsibility; and in the meantime the Bill provides nothing as to the removal of those burdens which make it necessary for the peasant to find help somewhere. The only security which the cultivator can offer is his tenant-right; the only man to whom there is any use in offering it is the money-lender; and until the tenant is relieved of the need to offer security at all, he will continue, by whatever by-paths and indirect crooked ways, to pledge and sell his tenant-right to the banking caste of the towns and large villages. But whence arises the necessity? Ah, that is a question which many are ready enough to answer, but which no Indian Government has ever set itself in earnest to solve. Perhaps we shall not much wrong our rulers if we believe that the reason of their indifference is a secret conviction that any really effectual remedy would imply—if not in Bengal in other parts of India—a considerable diminution of the revenues of the State. Their benevolence knows no bounds in theory; but in practice it keeps to its own limits with obstinate modesty. You shall have long minutes recorded on the desirability of a Department of Agriculture and Commerce, and salaries of equal magnitude attached to the principal officials thereto belonging, but when it comes to a simple act of charity, such as forgiving to an overburdened landowner some part of his debt to the State, high and mighty principles of policy compel the Government to turn a deaf ear to all entreaties, and with averted face and streaming eyes, to pocket its just dues from estates under the auctioneer's hammer.

Private persons, we have said, being blessed with leisure and unfettered by the requirements of statecraft in its most occult branches, and being thus qualified to feel some sort of sympathy with the decaying fortunes of the agricultural interest, have made their own guesses at the reason why landlord and tenant in these days are alike impoverished. It has been surmised that the settlement has something to do with the matter. Of course, this will not explain the alienation of tenant-right in Bengal, where the settlement is like the law of the Medes and Persians, and altereth not. But reasons are not as plentiful as blackberries, and one must take them as one finds them, content if after all one can attain to a partial and local explanation of a phenomenon common to all parts of India. Alienation of tenant-right is not unknown, by any means, in the North-Western Provinces, though it is there unsanctioned either by law or recognised custom, and must, in fact, operate to destroy the alienator's right altogether, if only the landlord thinks it worth while to put the regular legal machinery in motion. Possibly, when the new system of village records has been perfected, we shall be able to collect statistics both of the comparative frequency of such alienations, and also of the relative status of the tenant-right cultivator in various districts. At present one can only make rough estimates in the block, striking out very general results. For instance, we find the tenant-right cultivator most well-to-do in the permanently settled districts of the North-Western Provinces Next to them come the districts of the Upper Doab, where the settlement is notoriously light, having been made in days before imperial exigencies began to lie heavy upon the soul of provincial Governors. Worst of all are the districts where the assessment is known to be heavy, and where, ever since the settlement, the revenue courts have been deluged with applications for leave to enhance rents. Surely we may fairly suppose that the facts are not devoid of a certain significant connection. Where rents are for ever rising, the state of the tenant-right cultivator is the least to be distinguished from that of the tenant-at-will. But the enhancement of rents is a phenomenon as demonstrably connected with the settlement as the tides are with the movements of the moon. It is worth while to say a few words upon a matter of such grave import, though it has hitherto remained in the obscurity which delights to cover all important questions bound up with the every-day life of the population of India. A wave of settlement passes over the land, sweeping into the treasury sums unknown before. From one point of view, the result is satisfactory, and the attention of the Government, perhaps not unnaturally, has hitherto been engrossed by this aspect of the matter. And yet we should do wisely, in this as in many other questions of Indian administration, to recall the words of the Scottish monarch—though far be it from us to suggest any invidious comparison between his style of management and our present paternal system—

> If it were done when 'tis done, then 'twere well
> It were done quickly: if the settlement
> Could trammel up its consequences—

and was not followed by a second wave of rent suits, we should be spared some painful doubts about the operation of our main revenue machinery. Estates are assessed upon their potential productive powers; and landlords soon find it necessary or expedient to raise rents to the level of the settlement officer's estimates. Hence follows the abolition of all those little privileges which help to lighten the prevailing penury of the agricultural condition. The village headman ceases to enjoy his few acres at a nominal rent; the village carpenter, blacksmith, and other craftsmen, are obliged to surrender their patches of land to tenants who will pay for them at a larger figure, the ex-landowner finds himself deprived of the consideration hitherto vouchsafed him, and is placed on a level with neighbours who have not his title to the plea of decayed gentility; while the common tenant-right cultivator is called on to fight for his life against a sudden increase of his burdens by fifty or a hundred per cent. It is true that none of these changes can be made without the order of an English officer who has rendered himself personally acquainted with every man's case But not the most laborious and judicious officer can wholly save the cultivator from the legal worsening of his lot. If all enhancement suits were summarily thrown out, injustice would be done to the landlords with whom the State has just concluded a bargain on the assumption that they can get more than they have hitherto done out of their tenants. The blow may be eased off a little by due allowance for the tenant's present circumstances and future expectations, but in the end it is sure to fall. Adjudications of this sort are painful enough to a sensitive officer. His duty takes him into the fields and villages to wander all the morning over poorly cultivated fields, yielding indifferent crops, and owned by an undergrown and underfed peasantry, for the most part in debt, and all half clothed and wholly illiterate. On one side is the landlord, reciting fabulous stories of the productiveness of the soil; on the other are the tenants in a body, crying that the earth refuses to yield her increase. Neither party sees the slightest difference between the truth and a lie, nor feels any touch of shame when detected in the latter. Amidst this Babel of protestations, objurgations, and invocations of all the gods, the hapless Englishman moves from field to field while the sun is getting higher, trying to make his notes and to arrive at a fair average rent-rate for every class and condition of soil. Happy is he, if, after an examination as thorough as he can make it, he feels himself fairly able to refuse the enhancement demanded. But it more frequently happens that he must record a decree which, while amply warranted by law and by the facts of the case, still leaves him sadly aware that he has added another straw to the burden of that patient and overloaded animal, the Indian agriculturist. Nay, it will be said, is the tiller of the soil to be exempted from paying to the State his fair share of that increased value which has been conferred upon the soil by the State itself? An answer that would square with economic principles might no doubt be found. But a more practical answer is afforded by the actual condition of the peasantry in Rohilkhund of the North-West,—the most favoured tract of the most intellectually governed province of British India.

INDIAN HORSES.

HERODOTUS somewhere praises the ponies of Tirhoot. "The horses of that country," says the father of history, "are small, but of marvellous endurance." If the old Greek were alive now, he might tell the world his views upon polo, a game to which the Tirhoot ponies of his day do not appear to have been accustomed, for we find no mention of it in his communicative volumes. The quality of endurance, however, is one common to the Indian ponies of his day and of ours, whether natives of Tirhoot, or of the Deccan, or of up-country districts. It is in truth a quality which is often put to the test. Native ponies are constantly called upon to traverse long distances without a halt. The feat performed by Daya Ram's pony is historical That obstinate lord of Hatras, in the first quarter of the present century, put the Indian Government to the trouble of shelling his fort a whole summer day, by way of a coercive process for the realisation of the revenue which he refused to disgorge. In the night he fled, and before another night had fallen, his pony had carried him to the fastness of a brother chieftain in Bundelkhund. History does not say what became of the brave little animal,—whether the long march killed it, or whether it lived, as it deserved, to an honoured old age. Judging from the treatment of modern ponies by their masters, we fear there is small reason to hope that Daya Ram cherished much gratitude. Perhaps the fault is one characteristic of horse-owners all over the world. Even the romantic Fitz James, in Scott's delightful *Lady of the Lake*, has only a few common-places of regret for the good steed which he has ridden to death, and we all know how an humbler poet, who could, however, plead practical experience in the matter—Bloomfield, the farmer's boy—has depicted the farmer sending old Bayard to the dogs. Still, if an English master has little pity for his horse when past service, he does not, like the native of India, keep it at the point of starvation during its working days. The Indian Government, they say, is buying up ponies for the Cabul commissariat. These will have at least one advantage over the Indian camel, now become almost a thing of the past. They are much better accustomed to starvation. The camel, being a valuable beast, does get regular meals when at home, and one may presume, from recent mortuary returns, that it feels the want of them if driven fasting more than a week or ten days. The pony, on the other hand, costs about one-tenth of the price, and is supposed to feed himself, which he generally manages to do after a fashion. He is, in fact, an old campaigner from his birth, and therefore better adapted to keep body and soul together, without grass or grooming, in a land which produces for the most part nothing but stones and men. He is already accustomed to march thirty miles on an empty stomach, with a fat old landlord, or perhaps landlady, on his back, and expects nothing at the end of it except leave to do a little grazing on his own account, or may be a handful of thin grass is shaken down under his nose. Poor little fellow, he has need of all his historical virtue of endurance; and nobody can suppose that it will not be tested to the uttermost, if the day comes, among the rocks and deserts of Affghanistan.

The other quality, that of smallness of stature, is less desirable, but equally permanent. It is a trite saying that Indian horses are all undersized. So, too, for the matter of that, are the men and women; and the cause is no doubt the same in both cases, to wit, insufficient nourishment, and climatic conditions unfavourable to the development of robust vigour. The legs of the ordinary native are a lamentable spectacle; and those of his pony are worse. This results, in the case of the latter, usually from overloading while the animal is young. It often shews itself in very pitiable shapes. The curious naturalist might discover in India an equine species which is plantigrade, walking on the whole foot, like the bear, instead of on the toes only, as a horse should do. Yet even the common pony of the country, when he gets fair play, vindicates the national reputation in size and strength as completely as the tallest Sikh or the sleekest Poorbea sepoy. There is no dearth of polo ponies, though players complain of difficulty in getting them,—a difficulty due not so much to any real deficiency of supply, as to the want of a medium between the village-owner and the man in cantonments who desires to buy. A good pony is notoriously cheaper in India than in England, and if a little smaller, is probably for that reason all the better suited to the game. But after all, it is not by its ponies that the merits of a horse-breeding country must be judged; and when one turns to the horse proper, there is no denying that India falls far short of the home standard. One has only to take up an English and an Indian newspaper, and turn to the advertisements of horses for sale. The average height in the former will be found to be between fifteen and sixteen hands; in the latter between fourteen and fifteen. And this inferiority in height is accompanied by similar inferiority in bone and sinew. The Indian horse is light, like the man he is meant to carry. Our irregular cavalry regiments ride, on an average, from nine to ten stone per man; an Hussar, with his accoutrements, will weigh fourteen or fifteen. The difference is as old as the days of the Crusades, and as extensive as the geographical distinction between the warm countries of Asia and the temperate climes of Europe On the great Asiatic table-land, another breed of horses is met with, rivalling those of Europe in bulk and thews and large appearance. It would be worth while to try the result of a cross between the Turkoman horse and the English thoroughbred. The vast steppes of Turkestan seem intended by nature for a breeding-ground. Nothing corresponding to them is to be found in India; and their pure bracing air imparts a kind of life very different from that breathed by the hot-house atmosphere of this country. Yet India also has her breed of horses, more than one or two. Kattyawar has long been famous for its little horses of high spirit and uncertain temper, marked with that odd cervical stripe which seems to argue some distant strain of blood from the wild ass which still haunts the Runn of Cutch, lately left unvisited by Sir Richard Temple. The Deccan has its wiry race of fourteen-handers, descended from ancestors that carried many a bold Mahratta cateran safely from before the English guns. In the Upper Doab survives a breed of horses which boasts an Imperial origin. Aurungzebe, returning from conquests in Southern India, brought back with him, as a precious prize, two generous mares for the royal stud. Encamping on the northern bank of the Jumna, in that difficult country of ravines and scrub, the Emperor's wealthy train offered a splendid chance for booty to the wild Jats who have had their abode there for ages. They came by night and cut out the two mares, and carried them away northwards, where their offspring are to be found to this day, each with its family tree to prove a descent otherwise abundantly evidenced by unmistakable signs of blood, although the universal defect of lightness is not all redeemed by beauty and speed. In Rohilkhund, along the Ram Gunga, where broad river meadows, rich in clover and grass, present the best pasture ground the peninsula has to show, a stronger race of horses was bred in more favourable times, and still continues, though less and less, to furnish remounts to our cavalry and horse police. Cultivation is encroaching upon pasture; and the old land-owners, who prided themselves on their mares, are gradually sinking under debt and improvidence, while their successors, mere usurers and scribes, value nothing higher than an ambling pad. The sportsman who seeks duck and wild geese by the margin of the Ram Gunga's many pools, will still often notice a promising young foal trotting away scared at his approach, or grazing by the side of its mother, whose lean intelligent head tells of good birth and better days. And here and there he will find an English or an Arab stallion lent by the Government to the land-owners, who have had their mares approved and branded as fit for breeding purposes.

It is a pity that some little trouble is not taken to improve these various breeds of horses by the wholesome stimulus of competition. Here, as in most Indian matters, much rests with the powers that be. Horse-breeding in this country will never go on satisfactorily by itself. There is a market, but it is too distant to exercise the required effect upon the horse-breeder. We mean distant in point of time, rather than place. A foal needs four years' keeping before it becomes a marketable commodity; and it is vain to expect a native landlord to look so far forward. He will not devote care and attention to an object removed from him by the space of four whole years. And

so it happens that the foal is neglected, and the young horse is left to grow up as it likes, and to pick up a living where it can. Before the period is out, the owner grows tired of keeping an animal for nothing, and takes it into work before it is fit to carry a load. The consequence is either immediate breakdown, or a strain which shews itself in after years; and thus many a fine young horse is spoiled for life. Now, the Government might very judiciously interfere to prevent this, by substituting a more interesting object than the prospect of sale after so long a term. The owner's pride in his young horse might wisely be stimulated by offering him an opportunity of winning commendation and a prize for it several times during the interval. This could be managed by means of annual horse-shows in central places near the principal breeding districts. Probably the outturn of horses would be poor enough to begin with; but in a year or two the system would have become familiar to every one concerned, and horse-breeders would bring their young stock readily for inspection and judgment, while the prizes, besides being valuable with a view to future sale, would more than cover the cost of transit. Exhibitions of this kind already exist in a fitful sort of way. Certain principles of judging have been approved by the Government, and there is even a supply of printed certificates, so that no details are wanting. But all is marred by the long and capricious intervals at which the shows are held. Horse-breeders cease to take any interest in them when they come once in half-a-dozen years. They should be annual institutions, like any other large fair. Every horse-breeder in the country should be encouraged to bring his whole stock once a year to be examined, and to get prizes, if judged up to the mark. Such meetings would be frequented by purchasers, and the horse-breeder would have the double advantage of a good market and of the instructive lessons to be derived from a wide field of comparison. Competition at these annual contests would soon become an important factor in the improvement of the breed of horses. Every exhibitor would try to bring his animals to the test in the best possible condition. We should soon cease to see those ragged coats, prominent ribs, prematurely tasked legs and back, with an occasional galled shoulder or withers by no means unwrung, which deface so large a proportion of the young stock at the present horse-shows. The subject is one well deserving of attention. The stud system has rightly been abolished. No Government can breed horses for itself, any more than it can undertake to give rations to all its servants. But there is a medium between this and total neglect of the conditions under which the offspring of Government stallions, supplied gratis to land-owners, is allowed to grow up during the decisive years of its life.

MYROBALANS.

THE fruit of the Beleric Myrobalan (*Terminalia belerica*; N. O. *Combretaceæ* vern. (Bahera; fruit Har, Harra). Extensively grown in the Punjab; Eastern part of the Sewalik tract; Kangra district; hills and north of the Peshawar Valley; and generally in the northern and eastern parts of the plains of the Punjab, where the climate is tolerably moist for the greater portion of the year, as in the dry arid parts to the south and west it does not thrive.

It flowers in the spring and the fruit—which consists of a nut, enclosed in a thin exterior rind—ripens in the ensuing autumn. The tree attains a considerable size, 70 to 100 feet high, the trunk being regularly shaped, tall and straight, up to 10 feet in girth (occasionally 15 to 20 feet). the branches spreading considerably, forming a broad massive crown which gives the tree a very handsome appearance.

The trees are valuable, the produce of a single one has been known to sell for Rs. 2,000; the seeds are obtainable, generally, at from nine to twelve seers per rupee, though one seed has been known to fetch one rupee!

Economic Uses.—The *leaves*, in Kangra, are considered the best fodder for milch cows; and they are also used in dyeing. The *fruit* is employed as a mordaunt in dyeing cloth and leather; in tanning; making ink; used as an aperient medicine, a tonic, an astringent, and in mucous discharges from the lungs and bowels: when only half ripe, it is used as a purgative; it is also eaten by cattle, deer, goats, monkeys, and sheep. The *kernels* are eaten, but are considered intoxicating; they yield an oil. The *bark* yields an insipid gum The *wood* is yellow or light-grey, coarse open grain easily worked, but not durable chiefly owing to its liability to the attacks of white ants and other insects; in Kangra it is considered unlucky to use it for building purposes: previously to being used for building, it is advisable to season it by steeping it for some time in water: it is also used for packing cases, small boats, planks: a cubic foot of green wood weighs about 60 lbs, one-third of which it loses in seasoning.

A second variety is *T. chebula* (vern. Har, harar), which is occasionally cultivated in the Sewalik tract up as far as the Peshawur valley. The *wood* is durable, hard, heavy, yellowish tinge, wavy outline, making up into pretty furniture, it takes a good polish. The *fruit* is used by dyers as a mordaunt; also in tanning and in medicine as an astringent. The *bark* is also used for tanning and dyeing. The *galls* make writing ink.

A third variety is *T. arjuna* (vern. arjan) occasionally cultivated in the Punjab as far west as the river Ravi. It is a fine handsome tree, with greenish bark—seldom entirely leafless—attaining an altitude of 70 to 100 feet, the trunk having large buttresses for the first dozen feet from the ground. There are some very fine trees near Kangra. The *wood* splits in seasoning, is subject to the attacks of white ants, and is only used for agricultural implements and carts. The *bark*, in Kangra, is used to heal sores.

A fourth variety is *T. tomentosa* vel *Pentaptera tomentosa*. Grows in the Sewalik tract, as far as the river Ravi, and in places is found as high as 4,000 feet. The *wood* is used for building—though its durability is uncertain and it splits in seasoning—it makes good charcoal and potash and in burning as fuel it throws out great heat; the branches make good cattle fodder. This tree coppices well. The *bark* is useful for tanning.

The foregoing trees thrive more or less all over India, though this short description merely refers to the Punjab.

G. P. P.

EDITORIAL NOTES.

MR. A. DECLOSETS, C.E., has appealed to Government in behalf of science as well as of public utility for the loan of the *boring apparatus* in the Public Works Department Stores. Mr. DeClosets says—"There is a gentleman who is willing to go to the expense of boring an Artesian well in the tertiary and cretaceous formations about eight miles west of Pondicherry and upon the English ground under my direction. But he has not a proper apparatus to reach the depth required, and as such work requires much care and good implements, I have been induced to make you my demand. Should you agree to grant it, I will be bound to return the boring apparatus to Government after having used it, and in good condition. On a similar occasion when I was boring in the Madras Island (for a projected harbour) I had the loan from the Public Works Department Stores of a boring apparatus which I returned safely after." Mr. DeClosets refers to what has recently been done at Pondicherry in sinking Artesian wells, and thinks these wells will be valuable for irrigation purpose; there are now many inquiries about the practicability of these wells in several localities, and several borings have commenced. His opinion is that the water obtained at Pondicherry proceeds from the Poncar and perhaps Gingee rivers, penetrating the sands 10 or 12 miles westward inland. The boring apparatus asked for by Mr. DeClosets will be supplied to him on loan. The Government regard the subject as one of great interest, and will be glad to learn the results of Mr. DeClosets' attempts to obtain water from Artesian wells.

THE decline in the mulberry cultivation of Mysore is a result we presume of the famine. In the last administration report for the province, allusion is made by the Chief Commissioner to this decline. Mulberry is cultivated of course with a view to the feeding and rearing of silk worms, from which the raw material is obtained for silk manufacture, and formed the principal means of subsistence and income of many hundreds of families, specially of the poorer classes of Mahomedans. The cusbah town of Oscottah was at one time surrounded by numerous gardens of the mulberry tree: the old foot ditch of Kolar together with a good deal of land below the Kolar tank was cultivated with the same; while thousands upon thousands of mulberry trees were cultivated near Cosepett, Biddad, Chennapatam, Kingerry, and other places, which all belonged to or were tended by Mahomedan silk weavers. Within the past few years, however, the silk industry, which at one time formed no small

portion of local produce, has so far declined as to attract the attention of the local Government. Many years back, it will be in the recollection of some, that a silk factory, on a large scale, was projected at Kingerry, where *pucka* buildings, machinery, &c., were all erected; but the speculation never paid, and after sinking a large sum of money the Kingerry factory was finally abandoned and brought to the hammer. The silk worms do not appear to thrive so well as they did formerly, whether it be the fault of feeding—for perhaps there may be some disease in the mulberry trees—or any other reason, we cannot say, but it is a matter to which, should the Government, as it promises, give consideration it will result in to benefit the province and a large class of poor people.

THE average prices of middling Orleans and fair Dhollera cotton during the past 25 years, and the present prices, are given as follows:—

	1. Per lb. d.	2. Per lb. d.		1. Per lb. d.	2. Per lb. d.
1854 ...	5·37 ...	3·62	1867 ...	10·84 ...	8·53
1855 ...	5·76 ...	4·05	1868 ...	10·75 ...	8·50
1856 ...	6·36 ...	4·80	1869 ...	12·37 ...	9·81
1857 ...	7·82 ...	5·39	1870 ...	10·18 ...	8·12
1858 ...	7·00 ...	5·50	1871 ...	8·79 ...	6·58
1859 ...	7·00 ...	5·26	1872 ...	10·85 ..	7·61
1860 ...	6·56 ...	4·35	1873 ...	9·32 ...	6·15
1861 ...	9·06 ...	6·31	1874 ...	8·30 ...	5·28
1862 ...	19·17 ...	12·32	1875 ...	7·62 ...	5·00
1863 ...	24·35 ...	19·59	1876 ...	6·56 ...	4·50
1864 ...	27·68 ...	21·14	1877 ...	6·50 ...	5·19
1865 ...	19·50 ...	14·72	1878 ..	6·31 ...	4·87
1866 ..	15·78 ...	11·95	Present price	5·62 ...	4·06

The period of very lowest depression in the Indian Export Trade was from about 1846 to 1854 when the Crimean War became the occasion of opening the trade in oil-seeds with India. The figures in the above table are very discouraging. Prices have gone down steadily for the last 15 years and are now lower, than they were 25 years ago. The staple was just five times its present price fifteen years back, while there seems to be no limit to the fall that yet impends.

GREAT efforts are being made to improve the agriculture of Guatemala, yet the wheat crop of 1878 failed, and the Government was forced to reduce the duty on imported grain one-half. Coffee cultivation is being largely extended, and liberal terms are offered to immigrants to settle in the country and introduce permanent improvements in the way of irrigation works, roads, &c. Attempts are being made to open the oil deposits on the Atlantic coast in the neighbourhood of the Lampara and Vincent rivers. The trade of the Republic is steadily increasing. The exports during the past year reached nearly 4,000,000 dollars, as against 3,773,185 dollars in 1877, or half a million more than in 1875. The principal article of export is coffee, which represents the great bulk of the figures above quoted, but cochineal, wool, and sugar are considered items of trade. England supplies more than half of the articles imported into the country, France, Germany, and the United States the bulk of the remainder.

THE plantain has never become a favorite fruit in England but seems to be prized in the States. The annual amount of *bananas* imported into Boston during the season is about eight cargoes, worth 6,000 dollars to 7,000 dollars each, making, with 50 cargoes received at New York, a total of about 375,000 dollars as the value of receipts at New York and Boston. The banana season begins in March or April and extends into August. The North Coast of Cuba seems to furnish the fruit chiefly, shipments are also made from Aspinwall on the Spanish Main, from Trinidad and Jamaica.

ALTHOUGH Indian Model Farms have not been very successful, they have been the means of diffusing valuable knowledge amongst the cultivators. In the beginning of last year the Secretary of State requested to be furnished with information regarding the general working of the Farms throughout India. A *précis* of the reports has been prepared by Mr. Hume, and Madras of course is far ahead of the other Presidencies owing to the energy and experience of Mr. Robertson, who is revolutionising the agricultural world of the benighted Presidency.

In the Madras Presidency good and useful work is being done under the supervision and guidance of Mr. Robertson, the Superintendent of Government Farms. Attached to the Sydapet Farm, on which experiments of various kinds are tried, is an Agricultural College in which a complete course of agricultural instruction is afforded, and which is intended eventually to accommodate upwards of one hundred students. In view to a further diffusion of information, Mr. Robertson has proposed the establishment of small agricultural experimental stations all over the Presidency, each being placed in charge of a trained agriculturist, who is also to conduct an elementary agricultural class. This scheme is, however, at present in abeyance for want of funds.

Mr. Roberston's services are at last eagerly sought by all who would make the model farms successful. The versatile Governor of Bombay has decided that the Western Presidency is to have an Agricultural College, and is doubtless prepared to deliver a long lecture to the students on practical agriculture, as he gave the medical students the benefit of his views on the theory and practice of medicine the other day, and has instructed the volunteers in the science of musketry. To make the Farms attractive it is desirable to have Agricultural Schools attached to them, and the various Local Governments are at last requested to bring about some such arrangement. The Department of Agriculture and Commerce in the North-West under Mr. Buck has been attended with such excellent results, that Government contemplate similar departments in other parts of India. Lord Lytton asks for an early opinion from the Bengal Government, and the Local Governments and Administrations.

THE almost general practice in India of sowing mixed crops was recently made the subject of some remarks in a letter to the *Englishman* signed "D.N.R." The writer says:—

"Thou shalt not sow thy field with mingled seed" is one of the laws laid down in the Bible, and an uncommonly good one it is too. I quite believe that the pernicious custom of sowing mixed seeds has as much as anything else to say to the poor state of the crops and the lands. Moreover, I am prepared to swear that more *rubbee* was ruined during the present season, by this system of agriculture than by drought and frost put together. I particularly noticed how promising crops of wheat and barley lodged and spoiled after the mustard plant was gathered.

We commend these remarks to the attention of Mr. Hume's department, and particularly to the very able Director of agricultural matters we have in the North-West, in Mr. C. E. Buck. We suspect, however, that the matter is far from being so simple as "D.N.R." imagines, and that the ryot is able to give sound reasons for a practice that is almost universal in India. In prosecuting some enquiries in the Agra district a year ago, as to the condition of the people, we found that they were living upon *chuppaties* made of what is called *bejhur* in the quotations of the local paper, and *bejhara* in Carnegy's *Technicalities*, a mixed crop, generally of gram and barley. Strange to say, none of the gentlemen we spoke to on the subject, knew what this *bejhur* meant. They insisted that it must be *bajra*, a millet of the kharif crop, while *bejhara* is *rubbee* produce. It was not until we made our own house servants bring *chuppaties* before us in the actual form in which the poor consume them, that we ascertained definitely what this *bejhara* was. It is a common enough statement that the people prefer *chuppaties* of *bajra* and *jowar*, to the superior grains, and it was made to us at Lucknow only a few days ago, by gentlemen who ought to have known better. It is the deep poverty of the peasant, and nothing else, that compels him to live upon the coarsest and least nutritious grains, and to see the whole of his wheat crop taken to pay the demands of the State, the landlord, and the mahajun.

MR. BUCK is, we believe, going home to recruit his health, but we have little doubt that this subject of 'mixed crops' will command his notice, now that D.N.R. has made so important a statement concerning it. The uncertainty of the rainfall will, we suspect, be found to be one main reason for the practice, the cultivator sowing two crops, that, if the one fail, he may at least obtain something from the other, the crops not being equally dependent on the rains. D.N.R. can know very little, however,

of the real condition of the people, when he proceeds to make such proposals as the following :—

"The ryots should be made to take out licenses for the cultivation of such crops as opium, sugarcane, tobacco, indigo, and all oleaginous seed plants. An establishment of peons should be kept to see that these crops are not cultivated without a license, and these peons should be punished by flogging and fine when convicted of oppressing the ryots, or for bringing false charges against them. Good, active officers over these men could keep them in perfect check, as God's earth and the crops thereon will furnish all the witnesses required in a case brought by either peon or ryot. It would not take long to check all the taxable fields in a village; mixed crops of oil-seeds and food-grains should be charged for as if they only bore taxable produce. This in itself would check the evil of sowing mingled seed."

He then proceeds to show that the opium soil of north Behar is in process of exhaustion, and says :—

"If the average produce per beegah of opium in north Behar for periods of six years from season 1848-49 to 1871-72 inclusive was as follows :—

		mds.	s.	ch.	
From 1848-49 to 1853-54	...	0	6	4½	per beegah.
" 1854-55 to 1859-60	...	0	4	9¼	"
" 1860-61 to 1865-66	...	0	5	2⅛	"
" 1866-67 to 1871-72	...	0	4	8	"

"The above shows a decrease of nearly fifty per cent. in the produce gathered per beegah during a period of thirty years, and the result of the last six years will show a still more alarming decrease, as I am certain the average produce of north Behar has not been three seers per beegah from the land cultivated in opium. If the present system is continued, what will the produce be fifty years hence; and yet the cultivation of this crop on a large scale in India is still in its infancy, having been introduced by the English."

We are under the impression that the last statement is an error, but do not stay to verify it. If D.N.R. is right, however, as to this rapid deterioration of the soil, the opium agencies at Benares and Goruckpore should be required to report upon the matter, at length and at once. As the manufacturing season has just opened, Dr. Shepherd's hands will probably be full until August or September next, but he probably is the right man to make the enquiry. D. N. R. would have the opium monopoly abandoned and poppy land assessed instead at Rs. 10 the acre. How this would improve matters is not by any means clear, but D.N.R. will perhaps return to the subject. As it is, he simply says :—"The opium monopoly should be thrown up, "and a heavy tax of, say, Rs. 10 per acre might be imposed "instead for those who choose to cultivate this crop."

But this is not all. The unhappy cultivator's ways are to be corrected by "a light tax laid on all his crops, except food-grains, roots and tubers, to check the evil of sowing mixed seed. Great permanent benefit will thus be done to the agriculture of the country, and the Government will realise several millions sterling of revenue without any oppression or bother whatever."

But the cultivators as a class, are already groaning, literally 'groaning,' under the existing taxes, not because of their weight in themselves, but because of their abject poverty and total want of resources to meet them. A two-anna tax per acre is light enough, it will be admitted, but what is the man to do who has not got the two annas to pay ? Now this is the state of the peasant-cultivator under our rule so widely, that we are beginning to regard his condition with despair. The License-tax, light as it may seem to men sitting in the Council room at Government-House, *is afflicting the people so heavily, that we are reflecting upon ourselves constantly for having given it our support.*

Our readers know *why* we supported it, and how the Government that imposed it, has broken faith with us and with the people, and misappropriated its proceeds, "a misdeed of the first order," as one of England's greatest statesman, writes to us. But D.N.R. is both sanguine and heroic, where we are depressed under the presentiment of coming evil. He says :—

"If throughout British India non-food crops were taxed at something like the following rates, the agriculture of the country would flourish, and the Government would derive from 8 to 10 millions sterling of revenue :—

Poppy	...	Rs. 10	per acre.
Tobacco	...	" 5	"
Sugarcane	...	" 3	"
Indigo	...	" 3	"
Cotton	...	" 2	"
Castor seed	...	" 2	"
Mustard	...	" 2	"
Linseed and other oleaginous seed plants mentioned above,		As. 0	"

"You may say that the ryots would rebel and cease to grow these crops. So much the better for themselves and the future prospects of the country if they do, say I; as better men than they would take up the cultivation, and willingly pay the taxes mentioned above."

All we can say is, let the Government find out who "D.N.R." is, and try him with these new taxes by all means. As to imposing them upon the cultivator, the proposal is simple insanity.

We hear that Messrs. Begg, Sutherland and Co.'s experiments at the Poosah farm with the cultivation, and more especially the curing, of tobacco have been very successful. The public would be glad to know something of these experiments we are sure, and the Bengal Office may possibly be able to tell us what has been accomplished. The Poosah Farm was presented to the local Government about five years ago by the Government of India, for the special purpose of improving the agriculture of the province, but we have heard nothing of it since. Indian tobacco hitherto has simply been sun-dried or hut-dried, and if Messrs. Begg, Sutherland and Co. succeed in 'curing' the leaf, so as to make the tobacco valuable in the European market, we shall very quickly see Indian tobacco forming a new export of great importance in our Customs returns.

Mr. Robertson, the chief of the Madras Agricultural College has been putting his students through a course of gymnastics and has reported the results to Government. He formed a class of twenty-eight members who were exercised with dumb-bells, vaulting, and parallel bars, &c. The students who went in for gymnastics, Mr. Robertson tells us, "have enjoyed remarkably good health and are much better fitted for their training for out-of-door employment than they were previously." So satisfied *is the Principal of the efficacy of a good* combination of gymnastics and agriculture, that in a subsequent communication to the Board of Revenue he proposes to hold an athletic exhibition. He says, "I have the honor to request that the Board will be good enough to permit me to offer prizes to the aggregate value of Rs. 50, to be competed for by the students of the gymnasium class and other students of the School of Agriculture at a public competition in gymnastics, &c., I propose to hold some time about Easter, or earlier if arrangements can be made." Such an outrage on official sobriety as Mr. Robertson proposes to commit is too much for the Local Board of Revenue, who reply: "The Board are of opinion that the teaching of gymnastics is not calculated to further the cause of agricultural science. The case of youths whose studies are sedentary forms no parallel to that of generally older men whose training is largely conducted in the field." The proposed public gymnastic competition seems calculated to raise public doubts of the seriousness of the agricultural education imparted at the institution. The Board suggest that the gymnasium be discontinued. We are glad to find however, that the Duke of Buckingham declines to be bound over by the red-tapeism of such a respectable body. The Government Minute on the subject says :—"The Government do not agree with the Board in thinking that the gymnasium should be discontinued. The public demonstration, however, which has been proposed, is inexpedient." So Mr. Robertson will be allowed to retain his gymnasium which is "not calculated to further the cause of science."

The high estimation in which sewage irrigation is held by the cultivators is proved by the fact that the ground of the sewage farm at Allahabad brings in Rs. 20 and Rs. 40 per acre. The latter price includes irrigation. As market-garden ground, the farm holdings are eagerly sought after, and a

considerable addition to the income of the Municipality is the result. In Bombay, the utilisation of the town sweepings in the reclamation of the Byculla flats, although objectionable in many ways, has proved a valuable source of income to the Municipality, as the ground always commands a high rental, and applicants for fresh reclaimed land are never wanting. At Cawnpore, where some experiments in sewage farming have been tried lately, land has been let at more than Rs. 20 per acre.

The principal operations on the Cawnpore model farm during the past years were a follows :—Trials of English and improved ploughs, a trial of new seed wheat, experiments in subsoil drainage, trials with waterlifts, and winnowing by machinery. The drought which prevailed last year interfered considerably with the general work of the farm, and with most of the operations detailed above. The native cultivators do not appear to appreciate the English system of ploughing, although no pains have been spared to demonstrate the vast superiority of the process to their own primitive system. One of their principal objections appears to be that they are unable, when driving an English plough, to reach the bullocks' tails, and no well-conducted animal of that species, it is asserted, will work thoroughly without having his caudal appendage occasionally twisted. Another objection is that the ploughs are too heavy for the cattle. Some samples of the American plough which were sent out by the Secretary of State are the most suitable, and are more likely to be adopted by cultivators than any other kind. We have referred to the subject of the introduction of Improved Ploughs at length elsewhere. The trials with new seed wheat proved that the native seed was quite equal to that experimented with. The results of the trial of winnowing by machinery were very favorable, and it is probable that these machines may meet with the general approbation of the cultivators.

It is proposed to start a company at Agra, to be called the Charua Agricultural Company, Limited, for the cultivation of some land in the Hoshungabad district. The prospectus tells us that—

The land borders on a perennial stream, and is intersected by nullahs. Water is found generally at a depth of 5 or 6 feet below the surface. It is very fertile, and contains an inexhaustible supply of wood for agricultural purposes and fine grass for cattle. It will require very little clearing, so that within one year from the commencement of the operation, it is confidently expected that the first harvest will be gathered. Again, the land is almost centrically situated as regards the Presidencies of Bengal, Bombay, and Madras, and is only five miles distant from the Hursood or Kukian station of the Great Indian Peninsula Railway, so that the produce can be most cheaply and conveniently sent to the best markets of the world. The rent of the land is moderate and reasonable.

It is proposed to issue 3,000 shares at Rs. 10 each. An experienced manager is to be appointed, and a meeting of shareholders called as soon as 100 shares have been taken up. The project, which is entirely a native one, deserves the support of all who desire to encourage agricultural advancement amongst the natives of India.

A Correspondent writes :—There grows in South America a wonderful tree which has been called the cow tree, from the fact that it yields a milk so like that produced by the cow, that the inhabitants use it for domestic purposes in lieu of cow's milk. A French chemist has lately carefully analysed several specimens, and finds that in its properties, this curious vegetable production much nearer approaches cream than milk. In fact it is much more abundantly rich in butter and saporific matters than milk. Such a tree would be invaluable in India, more especially in such places as Wynaad, where milk is often with difficulty procured. The tree grows in Venezuela and New Valencia, and its botanical name is *Brosunum galacto dendron*; the natives call it palo de vacha. It grows in extensive forests, and attains a height of 100 feet or more.

The Department of Agriculture and Commerce in the North West Provinces and Oudh has introduced a system for the collection of trade statistics, which is likely to lead to valuable results. At present the returns do not exhibit that degree of accuracy which is desirable, but as soon as the system is thoroughly established, these inaccuracies may be expected to disappear. Mr. Buck is a most indefatigable worker, and in his hands the scheme is pretty certain to prove a success. In connection with this matter, we may also notice the endeavours which the same Department has been making for the promotion of trades and manufactures. The manufacture of Rhea fibre has engaged attention, and also the manufacture of glass and pottery, and the development of the silk and tobacco industries. These are some of the more important matters which have occupied the head of the Department for the past year.

COMMUNICATED AND SELECTED.

LADY BIRDS.

These little insects feed on the plant-lice (*aphides*)—parasites which prey on and injure plants and trees.

They appear in England, sometimes in immense swarms, and spreading over the fields, have caused needless alarm to the farmer to whom, far from being a pest, they are a blessing, from the fierce war they wage against his enemies the *aphides*.

In 1807 the shores at Brighton and nearly all the watering, places on the south coast were literally covered with them, to the great surprise and alarm of the inhabitants, who were ignorant that their little visitors were emigrants from the neighbouring hop grounds, where, in their larva state, each had slain his thousands and tens of thousands of the *aphis*, which, under the name of the "fly" so frequently blasts the hopes of the hop-grower.

The peasants in France collect and place them on trees and shrubs infested with *aphides* and style them "bêtes-à-Dieu," honouring their useful qualities; whilst the English name of 'Lady-bird" does homage to their beauty.

Some of the species are widely distributed, such as the very common *coccinella septem-punctata*, which extends its range over all Europe, and parts of Asia and Africa. They are frequently found on the summits of mountains at a very great elevation, as high as 9,000 feet; and the species in such places seem to be characteristic of the locality. *Aphides* are scarce in such, situations.

Is it possible to introduce these useful little insects as a check to the tea and coffee pests ?

G. P. P.

EXPERIMENTAL SORGHO CULTIVATION IN BRITISH BURMAH.

Thayetmyo District.

The sorgho seeds forwarded to this district for experimental cultivation, the despatch of which was advised in letter No. 1528-175, dated the 3rd August 1878, from the Secretary to the Chief Commissioner, was received in this district on the 12th of the same month. The seeds in quantities of 10 lbs. were distributed for cultivation in the Meaday, Mindoon and Kama townships. To the superintendent of the Thayetmyo jail was given a like quantity.

The experimental cultivation of the 10lbs. of seeds in the Meaday township was sown in an area of land, measuring 12,000 sq. feet. The seed was sown on the 2nd October 1878 in a sandy soil, and reaped on the 28th December 1878. The produce was one basket, weighing 46lbs, and the manure used towards enriching the soil was cow-dung. According to the report of the Assistant Commissioner of Meaday, some of the seeds appeared to have been eaten up by insects, and the consequence was a small outturn.

The unseasonable rains too, had much to do with this poor result. In the Mindoon township, only 8lbs. were sown on the 21st September 1878, and 2lbs. kept in reserve for cultivating during this season, of the 8lbs. were sown in an area of land measuring 1 acre 2 annas. 7 pies, and reaped on the 15th February 1879, the outturn was over a basket, a portion of the seeds were

sown on land on which maize had been grown, and no manure whatever was used to improve the soil. The seeds were sown broadcast.

In the Kama township, the seeds were sown in the months of August and September 1878 in 8 circles, in an area of land measuring 1 acre 9 annas 7 pies. The experiment proved a failure in all except the Natunie circle. The crop reaped here on the 1st January 1879 gave an outturn of one and one-eighth of a basket. No manure was used towards the improvement of the soil in any of the circles. The seeds were sown broadcast.

The cultivation in the jail garden was made on ordinary soil, 10 lbs. were sown on the 7th September 1878, on an area of land measuring 2,520 sq. feet, no manure whatever was used, and the seeds were sown broadcast. No conclusion can be arrived at from this cultivation in the jail gardens since the plants were destroyed by cattle at a very early stage of their growth.

The Burmese are not very favourable towards the cultivation of sorgho as it would seem from accounts given by them, that the new shoots, that spring up after the first crop, if eaten by cattle, will kill them. The "Piyoung nau Isa" which cattle feed upon bears a great resemblance to Sorgho, and it is reported by Captain Cresswell, that the Burman lives in fear of his cattle mistaking one for the other.

PROME DISTRICT.

The sorgho seed received was distributed to each myooke and sub-divisional officer in this district in quantities of 5 lbs. each.

In Pounday, Thaigon and Mahathaman the result has been most satisfactory, the plants growing from 4 to 15 feet in height, and flowered under two months after sowing. The result of the sowing in Showelay township is not so satisfactory. In Padoung the crop is progressing satisfactorily, but owing to late sowing has not attained any height yet. The same as regards Shwédoung.

The Assistant Commissioners of Padoung and Poundav consider that sorgho will grow in any soil provided there is a sufficient rainfall.

HENZADA DISTRICT.

The sorgo seed was distributed to the Extra Assistant Commissioners in this district, and sown by them. No directions however were given to them, and the experiment was rather haphazard in consequence.

Owing to a misleading term in the vernacular letter, forwarding the seed to them, they seemed to expect the crop would turn out a kind of sugar-cane, and their reports merely express their surprise that it is not sugar-cane.

The Extra Assistant Commissioner Kanoung however mentions incidentally that some specimens sown by him reached heights of nine or ten feet. Other specimens sent in from Zaloon were about the same height, and one from the Extra Assistant Commissioner, Henzada, measured 13 feet 3 inches.

The plants appear to yield abundant seed, but before it can be known whether they can be readily acclimatized or not, I would suggest further experiments with the seed yielding by them, to ascertain whether they deteriorate in this soil and climate.

THARRAWADDY DISTRICT.

The sorgo seed received was sown in this district just in the middle of the rains and proved to be a total failure.

This species of seed like that of cuzco maize seed, I am of opinion, will probably thrive on hilly ground when sowed just before the end of the rains. I believe the wetness of season and soil were the sole cause of its failure.

II.

In Madras Colonel A. Drury reports on the experimental cultivation of the *Sorghum Saccharatum* at the Madras Remount Depôt Farm, as follows :—

The first sowing was on the 2nd September 1878, during the rainy season, when 1 lb. of seed was sown in ridges 2 feet apart covering an area of 1,066 square yards.

The first cutting was on the 12th November 1878, or after seventy-one days, and realised...	lbs.	1,087
Second cutting after eighty days	,,	854
Third do, ninety four days		565
Total of green forage	,,	2,506

Besides this, about 170 stems were left for seed, from which 30 lbs. of seed was gathered at intervals.

The second sowing (5th November 1878) was two months later, when there was no rain; the beds were watered by hand but a third of the seed failed, and the remainder was not successful.

The third crop was sown after another month's interval about the 4th December 1878, just before a heavy fall of rain; the seed came up well, and the crop is doing fairly well, but requires irrigating.

The soil on which the sorghum was sown being cold clay, was perhaps not the best adapted, but it had been lying fallow for some time, and was well ploughed and manured before the seed was sown.

The sorghum is an irregular-growing crop, some plants being much in advance of others; it is therefore necessary to cut and come again, or the speedy-growing plants run to seed.

During the rainy season, or with plenty of irrigation, it may be a remunerative crop for cows and bullocks, but I do not think it will ever equal the lucerne as an irrigated crop for horses.

For cattle it may also be stacked and given as dry forage, but then it is not equal to good hay for horses.

THE CULTIVATION AND PREPARATION OF THE SOIL.

AT a recent meeting of the Chester-le-street Farmers' club, Mr. George Burnett, Washington, read a paper on 'The preparation of the soil, and the application of manure for the production of crops.' There was a good attendance—Mr. Chrystal, the president in the chair.

The Lecturer said :—I have chosen for this paper that part of agriculture which relates to the mechanical condition of the soil, and also the question of manures and their application. So interdependent, however, is the science and art, or practice, of agriculture on each other, that it is only by referring to the science of chemistry that we can get a reasonable answer for even mechanical processes. In the laboratory in subjecting certain compounds to analysis, it is customary to reduce it to powder, to add water to it and a little acid, to place it on a sand-bath so that by the application of moisture, heat and the acid, you render very rapidly soluble in water that which is insoluble; so it is also in the laboratory of the soil, we have the heat of the sun, the rains, and in the atmosphere an inexhaustible supply of carbonic acid. The labours of the husbandman supplement this chemical action more or less. By steam, by horse power, and by manual labour, he reduces the soil to as fine a tilth as possible, and as deeply as his resources admit, which then permits the circulation of the air, including its oxygen and carbonic acid, of moisture also which, besides permitting chemical action, is the medium whereby the salts necessary for the existence of the plant are conveyed by the roots for its support. The soils of our country are so varied that it would be a mistake to assume that an invariable rule of culture would succeed in all. Some lands, reduced to a fine tilth, would run together like cement with the first heavy rains, especially if it commences to rain as soon as the work is done, and before it has dried a little on the top. Drainage has done something for this land, and its condition has been ameliorated by deep tillage; a judicious course of cropping helps also, considerably. The contents of our ash-pits are also useful. Still in rainy, and consequently, difficult seasons a farmer may see the season passing away, and he can neither plant potatoes nor sow turnips. What remedy is there here, as the green crop fallow is admittedly the best time for the thorough culture of the soil? We agree, I presume, that land should be ploughed in the autumn, and deeply ploughed also. I have seen lands cultivated, but with some exceptions it is too retentive of moisture, and too much moisture prevents the circulation of the air, and keeps the land cold also; and as the conditions for chemical action are wanting or impeded, the land will not improve in fertility as it otherwise would do. There is also a great natural difference in the quality of soils, salts of phosphate of lime and of ammonia being the most valuable, that the labour bestowed on some soils would produce more crops than double the labour of others. Geologists tell us that this arises from the varying nature of the rocks from which our soils are formed, and that the soil of the Lothians and of the coal measures are a great contrast. However, all soils more or less contain the elements that plants require, and air, water, and the heat of the sun are to be utilised. We cannot increase the surface of the soil, but we can the depth, and thus add to our producing power, with the addition of manures also; and that he who does so in the most effectual manner will best succeed in unlocking the treasures of the soil. Just as the wind and tide are always on the side of the best sailors, so the skilful agriculturist draws most largely on the great laboratory of nature, and renders the richest harvest for the service of man. Well, supposing your land ploughed or cultivated in the autumn, it is seldom, if ever, too dry for that operation. The season is wearing round for putting in green crops; one of two things may likely happen, either the season is a good one or a bad one. If it is a good one, then is little to be said, as the land is speedily bu[illegible] up and your crops put in first-class condition. But

the season is a bad one. We will suppose one of the worst ever known; we cannot cultivate, we cannot plough, nor manure, and, to use a common expression, we had better be in bed and asleep than try to do anything of the kind. But what is to be done—are we to look on with folded arms and see the season passing away? Certainly not. If you cannot plough or cultivate, perhaps it may be grub harrowed or harrowed with the common harrow, or as a last resource, drills may be raised on the stubble furrow. No doubt many will object to this, and say justly what becomes of our theory of cultivation with such an inadequate practical outcome? Well, it is best to keep before us the highest standard, and steadily work to that end. Well or ill put in, however, your green crop is planted and sown, and we have a braird and no summer fallow. This is of some importance. Our attention must now be directed to the after cultivation of the green crop. Land that was not well put away will require a closer attention; the season at some period will be suitable, and such land will require an extra turn with the drill-grubber; and long before the end of the season an experienced eye could scarcely tell in which manner you had arrived at the result. The drill-grubber of modern construction is of strength sufficient to bear the strain of two horses working up to their power. This simple instrument has contributed very materially to successful results in green crop growing. Prepare the land for green crop, it matters not how well, the after cultivation adds considerably to its value, but when badly prepared its after culture becomes all important, so that in the autumn, when the green crops are removed from the soil, its condition is something approaching a deep body of well-cultivated soil, fit for the commencement of the rotation. Concerning the propriety of increasing the depth of the soil much may be said. Few soils are so good but that the subsoil will damage it when first brought to the surface. Yet all soils contain the acids and bases necessary for the growth of plants, in more or less abundance, and in more or less available condition. Some substances require oxydizing, such as protoxide, or black oxide of iron, which, becoming converted into peroxide, is healthy and necessary for plants. Also inert vegetable matter is highly useful in active decay. Carbonate of lime is not assimilated until it is converted into bi-carbonate, which therefore requires the action of the air. The safest plan, in my opinion, for the deepening of the soil is to plough your ordinary depth in autumn, and in spring to go deeper with the cultivator, so that the subsoil is gradually prepared for coming to the surface in another rotation. There is an objection to this course, that by so deeply stirring the soil the surface soil which has been mellowing by the winter's frost disappears to some extent. A remedy for that may be found by cultivating early, so that the beneficial action of frost, or of wet and dry weather may still be attainable; and some lands may be cultivated in the autumn. No doubt, on many lands, in dry seasons to loose the soil mellowed by frost renders the braird of the turnip crops very precarious, and to cultivate deeply when the soil is damp is often the forerunner of a failing crop. But land can be so cultivated under other conditions. If you grow potatoes, the same reason does not apply, nor with bare fallow, if you have any. If the land is ploughed an inch deeper each rotation, I should say it is safe enough; but with confidence in or security from your landlord, and you can afford the outlay, plough the land a foot or more in depth, and in the second rotation you will reap the benefit. To apply manure to the soil is one of the most important duties of the farmer. If he forgot that, he has forgotten everything, for it is the one thing he can the least afford to neglect. The quantity of manure put on the soil is to a great extent, the measure of the crop you receive from it. No doubt the soil yields a portion in proportion to its natural wealth and treatment, skilful or otherwise. From ten to fourteen bushels of wheat per acre, I am told, is something like the product from soils in America, as the result of cultivation without manure. It appears, therefore, that if we wish to grow six or seven or eight quarters of wheat to the acre after heavy green crops, how largely we must be indebted to our manurial resources; and the kind, quality, facility of obtainment, the mode of application are all matters of great consideration. I shall not attempt to go very much into detail, it is not altogether my object in this short essay, but rather to convey to you some leading features as they strike me. I dare say, if we had sufficient farmyard manure, we should be content, but in the nature of things that cannot be. Manure made from cattle fed on turnips, hay, meal, and cake, contains all the elements plants require but the barley and wheat and potatoes have been sold off the farm, and the cattle took their bones along with them to the market. How do we renew those salts so vital to the growth of the plant? You would naturally think we would go where our wheat, barley, potatoes, and beef had gone, to gather back the refuge—precisely what we want. Nothing could be better—nothing so good. Even the bones can again be had ground to powder—thus assisting their decomposition when put on the land and gradually giving out their invaluable quality, and so the chain of animal and vegetable life would be complete. The late Baron von Liebig told us that a pound of bone is equal to a hundred weight of corn; he told us also that if we burn a plant we have in the ash all it ever received from the soil. These small quantities seem easily attainable. Twenty per cent. per ton soluble phosphate spread over three or four acres seems a liberal dose with the addition of farmyard manure; but it requires an abundance for free growth, and it is not clear to me that bone rendered soluble in water by means of a powerful acid, is exactly what one requires; for soils are no doubt wonderful retainers of manures; yet the main drains reveal the secret of the land's management when we come to the analysis of its waters. I have yet to learn that dissolved bones are the best application for a four or five course rotation. There is no more science in the decomposition of dissolved bones than in a recipe for making blacking, as Liebig told us, and he was the originator of the system. I believe manufacturers generally throw in a dash of nitrate of soda or sulphate of ammonia, and sometimes the farmer appears to be astonished at the result. Perhaps the annual application of superphosphates in small quantities may be a judicious investment. Mr. Prout, who grows wheat after wheat in succession with annual top-dressings, appears to have found it profitable. His crops, which I have seen, were very creditable. The inhabitants of towns adopt no means to assist the agriculturist, but the reverse. Their ambition is to have waterclosets and sewerage to draft all refuse to the sea. Now the loss from this cause is incalculable. Were some system of earth closets adopted, fulfilling at the same time all sanitary conditions, as our friends the Chinese appear to be able to do, and the enormous manurial wealth, from the metropolis of England, to small provincial towns, brought back to the land, I should say that our extended commerce is very good, and gold from Australia is good, guano from the Pacific is still better; for a nation with a mighty commerce and starving soils at home is not in a good way and shows a declining patriotism. Were this enormous manurial wealth returned to the soil, another, a greater and more solid form of wealth would be added to our land, and I would make the nation rich beyond the dreams of avarice. The alternative is here also. At an enormous expenditure the sewage of London has been taken farther on before it is discharged into the Thames, and that has only put off the evil day. It is no remedy, even in a sanitary aspect, for as the tide rises it carries it back up to the river, and before it gets to the sea it is again carried back like a churning process or an antagonism of heart, and it is not unlikely to breed a pestilence. With regard to the application of manure, farmyard manure naturally comes first under consideration. It is a common practice in many districts to spread it on stubble in the autumn, and plough it in, and as this is done by many whose opinion on other matters is highly valued, it is entitled to serious attention. The land has a wonderfully retentive hold on all manurial matters committed to its care, and farmyard manure only gives out the food for plants slowly and gradually. By being intermixed with the soil, it is in the best available condition for the use of plants. Manure put on the land in drills suffers from the disadvantage of not being properly intermixed with the soil. The plant has abundance immediately under the roots, but is starved in other directions. But, as you cannot grow crops on a dunghill, so the storing up of manure in drills without due admixture with the soil does not appear to be altogether desirable. Were the manure in drills to be mixed up by means of the drill-grubber, it would entirely alter the matter; but with regard to farmyard manure, I question much that it is practicable. Another great advantage to be derived from this autumn manuring is the great facilities it offers for getting a large breadth of green crop grown and planted in the spring; and this is our great reason which overpowers other considerations, even if it wer objectionable. The advantage of manuring in drills is a practice that ha many advocates, and perhaps the larger breadth of land in the county i so manured. The latest-made manures are made speedily available, an do not, therefore require so large a stock of manure to be gathered u beforehand as the other system; and if the soil and the manure are no intermixed, they come very much in contact, and the effects on the crop ar unmistakable. Indeed, you would naturally suppose that in the earlie stages of the growth of the plant, it would grow quicker than when th roots had to strike a long way to procure their food. In this place I hav no comparative values to offer you as to the best of the two system though, no doubt, some gentlemen here will have something substantial t offer us. With regard to scavenger manure from towns, and which is muc used in this country, I have had some experience of its effects. It ough to be the great manurial supply of this country, but with a complet introduction of the sewage system it would be of no value whatever, and am afraid the quality is deteriorating. I object to ploughing it down o stubble. My reason is, that all manurial matters have a tendency to g downwards with heavy rains. We are told, and no doubt it is true, th in dry weather it will rise again (dissolved in water) by capillary attractio for the use of the plants; but a great deal more rain falls on than rises fro the lands; hence our springs and rivers carrying off at the same ti wealth from the soil. We, however, obtain a portion of our supply ammonia from the atmosphere by rains, especially after intervening fi weather; hence the double benefit of occasional rains. In very ra seasons the crops do not thrive, and the harvest is unsatisfactory. I imagine the food of the plant is continually being carried downwards. F this reason, I would keep all manures as near the surface as possible; a were it not for the escape of the volatile ammonia and the necessity decomposition, they might be on the surface. The mechanical conditi of the refuse of towns enables you to put it on stubble and cultivate it or plough stubble, and apply the manure and grub it in. Drills may manured with it, and you can manure after you have sown your crop, in all cases have good results. I know some farmers prefer this man ploughed in with the stubble in the autumn; but I have tried it, and result was always disappointing to me. I have given you my reason my practice. If I am wrong, I hope you will be able to show me, for are learners. We sip the foam of many sciences, requiring to know th so that we may get a benefit from each. We convey our information fr to each other. We have no trades' union, no protection, no patent righ and we never put up a notice that there is 'No admittance except business.' The application of sewage to the land, I am afraid, can o

be limited, partial, and local. It is not suitable for all seasons or all kinds of crops. Even Mr. Mechi, I should say, would scarcely contend that the irrigation of the soil by means of liquid manure had been successful pecuniarily, and he has advantages that the inhabitants of towns have not, he can choose his time of application, but those must have a constant outflow. However, therefore, you may admire his farm and crops and system, you gradually perceive on reflection that his tank and pipes, hydrant and hose, would cost large sums of money, and the resources of the farm still inadequate to render back sufficient manurial matter to the soil, and that it was not advisable to distribute supplemental manures such as horse and cow manure, dissolved bones, and guano, or even bullock pudding, in that way. The kind of manure depends, to some extent, on the course of cropping, and also on the nature of the soil. Phosphate of lime is as necessary to the plant as bone is to the body of the animal, but some soils require special treatment, and the application of lime is sometimes directly beneficial to the growth of the plant, apart from its chemical action on other matter, in the soil. Land that was once considered unfit for green crops fallow, by good management ultimately becomes so, being ameliorated by the addition of vegetable matter from manure, the roots and refuse of green crops, drainage and deep tillage, it becomes altered both in colour and texture. I have seen the pan at the bottom of the furrow on which horses had trodden perhaps for centuries broken up by steam, and the change for the better in the drier and mellower condition of the soil was something extraordinary. The question to what extent land should be cultivated is an open one, grass land without any cultivation whatever continues to grow good crops without any manure except the droppings from cattle, yet in the preparation of land for turnips it generally receives an amount of labour equal to three ploughings. Mr. Smith of Woolston sets to work with his steam-engine and double mould-board plough and grubber combined, and raises drills from manured stubble. I have not ventured to follow in his foot steps, but must admit his land was in excellent condition and cleanly, and if his land is sufficiently cultivated, and I am not prepared to say it is not, he certainly does it with a minimum of labour. The application of steam to the cultivation of the soil has one great advantage over horse-power, in so far as the power of the steam being transmitted by means of wire rope avoids the trampling that is caused by the feet of horses. I dare say you may expect me to give you my ideas on the comparative cost of steam and horse power. This is difficult; but it is not necessary to have so many operations on the soil with steam, as the treading of horses undoes part of the benefit. The want of success which has fallen to the lot of many companies and even private owners is very little argument against the steam cultivator, for it has not been taken to 'with love.' It is not part of the system, and a due preparation for its introduction, as regards gates, roads, and fields, has not been granted to it. These things are changing a little, but the farmer is slow and sure. Yet we have seen great changes in our times, more, I should say than during the same period in previous history. A law of the ancient Britons compelled every man to make his plough before he should guide one and the driver had to make the traces from withes of twisted willow. So late as 1631 the Irish Legislature passed an Act, entitled, 'An Act against ploughing by the tail, and pulling the wool of living sheep.' It appears the Legislature had discovered that it was a barbarous practice to attach the plough to the tails of the draught animals. Then we come down to the fine figure of Jethro Tull, the father of drill husbandry, and next we have the discovery of drainage, and last of all, when everything is ready, the chemist comes on the scene and unlocks the secrets of the soil and the atmosphere—shows us their beauty and utility. The skilled mechanic is beginning to be skilful enough to help us also, and he got a hint that he would have to do something, his services being required, and he is bettering the instruction. Our farm labourers are getting the qualifications of mechanics. I observed in a leading article in the *Newcastle Daily Chronicle* of November 16th that a short time ago farmers were the resolute foes of education, that we neither cared for it ourselves, nor wished our labourers to acquire it, that in fact a knowledge of arithmetic would ruin them. I should like to know when that time was. But it appears we had some excuse, as we followed a very unlearned occupation. No education, we are informed, technical or otherwise, is required to work the scythe or the sickle. Good mowers were never very plentiful, neither were good shearers. Bad mowers were constantly tinkering at their scythes, and half killing themselves at their work. For to graith his own scythe, to consider the angle at which he bends his back and his height, before he sets his scythe to grass, he is resolving questions in mathematics. Pray what sweep should his scythe have that it may cut evenly from heel to point? Workmen have pride in their work, unless men like this writer are able to destroy it. We have complaints enough of scamp work. If there is nothing to learn in mowing, there is nothing to learn on the farm at all, and no necessity to go to school or college, but we know better. We go to school and college to amplify and confirm our practical knowledge. Education we require, but arithmetic helps us a little. Our men require a knowledge of anatomy, physiology, pathology, and chemistry, and, in fact, the whole circle of the sciences, but they must be able to manage a pair of horses, to stack, plough and mow, and to know when the cow will calve, when the ewe will lamb, and to detect the first symptom of disease in the stock, and know when the land's a brimming. They imagine they know the right angle for laying up ploughing; and if any one thinks he can do better, let him [illegible]. We cannot do without intelligence; and at this day the farm labourers [illegible] country are amongst the best paid of any class of labourers in the kingdom.

DR. VOELCKER ON AGRICULTURAL CHEMISTRY.

Dr. Voelcker delivered, at a meeting of the Midland Farmers' Club in Birmingham, an interesting lecture on 'Agricultural Chemistry in Relation to the Exhaustion and Improvement of Land.' Dr. Voelcker having been introduced to the meeting by Mr. Howman, vice-president of the club, said—It would have been a source of very great pleasure to him if, in giving his address, it had been in his power to congratulate them on the high price of corn, an unusually favourable season, general agricultural prosperity, and bright prospects for the future. That pleasure must, however, be denied him on the present occasion, for he feared he had rather to condole with a good many British farmers on account of the heavy losses which they sustained through no fault of their own during the last and several preceding seasons, and to express his sympathy with them in these hard times, which, although he was glad to say they had not affected his own pocket, had seriously affected some farmers in this country. The present position of the British agriculturist, it could not be denied, was not a very enviable one. What with the low prices of corn, the large importations from the corn-growing districts of America, Australia, and even India; the importation of live stock from America, and dead meat from the same country and from the Continent; the increasing price of agricultural labour, the insecurity of tenure, the difficulties regarding compensation for improvements, and other adverse circumstances, the position of the British agriculturist is not an enviable one, and must be one of continued anxiety—(hear, hear). Still, they must not lose courage; there was the bright side of every thing, and certainly they did not mend matters by looking only at the dark side. The English farmer must be prepared to meet the foreign competition by which he was now threatened, and the question was, how was that to be done? He had thought a great deal on the subject, and had come to the conclusion that the only way to make farming more remunerative—for in all probability they would not get the high price for corn which they obtained in former years—was to grow more corn and every kind of agricultural produce, and reduce as much as possible the cost of production. It was quite true that they had foreign stock imported into this country in large numbers, and as this foreign food was supplied at a very low price, it became all the more necessary for the English farmer to direct more attention than had been hitherto given to the production of meat at a cheap rate. In the present season there had been an abundance of green produce owing to the showery weather, and many farmers would not derive the advantage which was to be obtained from purchased food when given in addition to the natural produce of their land. The low price of foreign grain and cake used for food purposes was most astonishing to him, and it was remarkable that oil-cake, which was at present obtainable at such a low price, was not more freely used. The farmers replied that they had an abundance of green food, and they need not buy any foreign food. Perhaps they would allow him to say that this was just the time to buy food, in the shape of foreign corn or oil-cake to supplement the home produce, and they would find it would return them a high percentage for the outlay; but if they fed their stock principally upon purchased food, they would find the bill of their cake merchant very ruinous. Now was the time to give some additional food in the form of oil-cake. The subject, however, upon which he had come to address them was the chemistry of the soil, and not the chemistry of feeding or fattening cattle. There was a great difference of opinion with regard to what could be got out of land. Some farmers were constantly grumbling about the bad character of their soil: they maintained that it was irretrievably bad, and that nothing could possibly be got out of it. He had heard that morning of land which was so clover-sick that they could not possibly grow anything on it, while others maintained that their land was so rich that they could apply to it no end of nitrate of soda, and grow heavy crops of corn; and, in fact, the more nitrate of soda they applied the heavier would be the crops, and they might go on from year to year without exhausting it. Now, when one heard such diversity of opinion, they generally found that the truth lay somewhere near the middle, and he purposed making some remarks upon what was called the natural fertility and the acquired fertility of land. It was, he believed, an undisputed fact, that all soils had a natural productiveness which they could not permanently raise. By suitable manurial dressing the fertility of land could be increased for a time, but as soon as they left off the application of these manures the land relapsed into its natural condition. They knew that land might go out of condition very rapidly by bad farming, over-cropping, or treatment with improper kinds of manures. They could get land in good condition with tolerable rapidity also, although they could get it out of condition much faster. It must, of course, be the aim of every farmer to keep his land in good condition for his own sake, if not for the sake of his landlord; and while it was quite true that they could not materially increase what he would describe as its permanent fertility. That led him to observe that there was no need for that fear, which was sometimes entertained, that damage would result from relinquishing the usual rotation. When they had to deal with rich clay soils, they could make themselves independent of strict rotation of crops. They might follow a number of wheat crops by barley without materially deteriorating the permanent fertility of the land. That course of cropping would, however, be impossible if it were followed on soils of a naturally low fertility. He was quite certain that if the farmer in future wished to meet the competition of the foreign producer he must give up farming in a mere routine fashion, and be guided by a more rational system of procedure—he must give to the lessons taught by modern science a more

prominent place in his operations, and bring to bear at the same time more the principle of commercial calculation and enterprise—(hear, hear). It was, then, to the progress of science and commercial enterprise that they had to look for a remedy to meet the growing competition to which the British farmer was exposed. As long as there was such a vague notion of what was fertile land, and what was naturally a good productive soil, they could not be surprised that many farmers committed grave errors. There were various reasons for bad farming—some had not sufficient capital, others had not sufficient intelligence, and many did not bring to bear the necessary calculation. They must be aware that fertility of land depended upon some material substances which were found in the soil; and it was quite clear that chemistry threw considerable light upon farming practice. There were some soils extremely poor in particular substances which affected more than others the productive powers of land and they might at once inquire what those materials were. The most important one was nitrogen in some shape or other, either in the shape of nitrates, which were most energetic in their action, but at the same time very perishable, as they rapidly passed into land drainage; or it may be nitrogen in the shape of ammonia, or ammonia salts, or in the shape of nitrogenous matters, which enter rapidly into decomposition and furnish first ammonia and finally nitrates, which, in his view, were most effective plant-feeders, from which albumen, gluten, and other nitrogenous compounds were derived. Available nitrogen in some form or other was a most important soil constituent, and existed in soils in but small quantities. There was another important constituent of the soil, and that was phosphoric acid, which existed in land in small proportions, and in poor soils in very small proportions; so it followed that land which was constantly cropped required to be supplied with manures which contained phosphoric acid in some form or other. Another important constituent was potash, which, however, was found in considerable proportions in the better descriptions of land, such as moist clay soils, with the exception of poor clay soils in the coal measures. In order to give an idea of the poorness of some land, he referred to an analysis which he made some years ago on some very light soil, and which was proved to contain 92 per cent. of sand. Some ten years ago he tried some experiments on Lord Wenlock's estate with a view of ascertaining the best means of growing clover on light land. He found the land extremely poor in nitrogen and potash, and very poor in phosphoric acid. They could form an idea of the poverty of the land from the fact that it contained 92 per cent. of sand and only ·08 of phosphoric and ·14 of potash. The manures used by him were nitrate of soda, sulphate of ammonia, mineral superphosphate, common salt, a mixture of mineral superphosphate and nitrate of soda, and also mineral superphosphate with potash salts. He found that mineral superphosphate, that was, superphosphate made of purely mineral matter without any organic substance, had no effect whatever on the crop and when he used potash alone there was the same result; but when he put the mineral superphosphate and the potash together, he got a most marvellous increase—viz., from 8 tons 5 cwts. 40 lbs. to 13 tons 15 cwts. 40 lbs. The mineral superphosphate alone would not act, because there was another element wanted to bring it into activity, and when that was supplied they saw what a marvellous effect was produced. That showed how necessary it was to notice the chemical qualities of the soil. He had made numerous experiments in which potash had no effect whatever, either alone or in conjunction with superphosphate. Some farmers present might know districts where bones had no effect—(hear, hear). Unless they took into consideration the natural character of the land, they might waste a great deal of expensive manure, but if judiciously applied they would get a very good return for their outlay. Nitrate of soda was a most useful manure when properly applied, but when it was injudiciously used the money might be wasted, and at the same time a serious injury occasioned to the land—(hear, hear). Thus he found in his experiment on Lord Wenlock's estate that nitrate of soda, when applied alone to land, had the effect of exhausting it in one season, and on the other hand, where he used superphosphate in conjunction with potash salt there was a considerable increase in the produce. By the selection of proper kinds of manure they might do themselves good in raising larger crops and leave the land in a better condition, but he would warn them against the injudicious use of nitrate of soda on very light land. There was another circumstance regarding the use of nitrate of soda on light sandy soils: when there were mixed seeds the clover disappeared like magic when it was used, and in the second cutting often not a single plant of clover was left. They could gain a great advantage from the use of nitrate of soda if they applied it to cereal crops in naturally fertile and productive land. He had tried it at Cirencester for a number of years, and found on heavy land an increase which over and over paid for the outlay. He found 1½ cwt. of nitrate of soda mixed with the same quantity of common salt to answer very well, and there they had proof that the very manure which was the farmer's friend mighty when misapplied, become his greatest enemy. If they put nitrate of soda on soils which were specially deficient in the more important mineral and essential constituents—potash and phosphoric acid—they were sure to do mischief, and get the land out of condition; but if they knew how to make the right use of it, which they could only do if they had some knowledge of the chemical properties of the soil, the requirements of our crops, and the best means of supplying them to the land, they would find it of considerable advantage. He would give an instance of the successful cultivation of land not in accordance with ordinary practice, and briefly refer to a novel system of cultivation which had been practised now for thirteen years by his friend Mr. Prout, of Sawbridgeworth. Fifteen years ago Mr. Prout came to him and acquainted him of the fact that he had taken some land, which had the reputation of being exceedingly poor. He expressed a desire to be as independent as possible of stock, and he (Dr. Voelcker) advised him to dress the land well with stable dung. Mr. Prout tried that but gave it up at the end of two years, when he came to him again, and said that it was too expensive a kind of dressing—attended with most inadequate results. He (Dr. Voelcker) suggested to him that probably he had not used sufficient manure, but Mr. Prout replied that he could not afford any more. Upon that he (the speaker) went down to the farm and made a thorough examination of the land, and advised him in regard to certain manures which ought to be put on. Mr. Prout followed the course which he suggested, and it was carried out in a very admirable manner. He had followed it out now for thirteen years with most satisfactory results. Some of them might probably be aware that Mr Prout sold off the whole of his produce. He did not recommend that as a general practice for a tenant, but he pleaded for the intelligent tenant that he should be allowed more freedom of action than he generally possessed—(hear, hear). If he had a lease, and with certain proper restrictions were allowed to do what paid him best, it would be better for himself, and also of benefit to the landlord —(hear). There they had an example of how a tenant might do himself good if he was at the same time his own landlord. Mr. Prout bought his farm, which comprised 450 acres in 1861, at the rate of £33 per acre. He spent upon it another £16 an acre in improvements. The land was of a heavy description and not of a light kind, on which they should not use any nitrate of soda, but it was of a description which he might call fertile in a natural way when properly cultivated. Mr. Prout produced more than from 40 to 50 bushels of wheat an acre, and the great secret of his success lay in the fact that he never stinted the land in artificial manures. He found that on an average he spent from £2 to £2-10s per acre in purchased manures, and what he relied upon were bone dust, superphosphate, dissolved guano, and a moderate dressing of nitrate of soda on the heaviest description of land. Another great secret of Mr. Prout's success was, that the plough was put to his land almost as soon at the crop was off. But perhaps they would allow him to make a little remark in passing with regard to steam-ploughing. Some people had an idea that one advantage to be derived from the steam-plough was that they could go over the ground with it at any time, no matter whether the land was wet or dry. A greater mistake had never been made. They could no more go when the land was wet than they could go with four horses on wet clay land. If they wanted to cultivate clay soils properly, they must not go with the steam-plough on the land when it was wet, or they lost all the advantages of cultivation. It was not merely the horses' feet, but the pressure of the ploughshare that consolidated the land and made it work so badly. The steam-plough did just the same as the horse-plough. If they wanted to derive the greatest advantage from steam-ploughing, they should take the land when it was dry, and keep the clods as rough as possible. The weather would produce the mellowing effect better than any instrument they could use. Therein was one of the great successes of Mr. Prout's system of farming. He broke up his land in autumn before the rains set in; he broke it up as dry as possible, and thus got rid of a great many of the weeds, which could only be exterminated when the soil got caked up. On some of his fields Mr Prout had grown wheat for a succession of years. In some cases he had grown four crops in succession, and had followed those with a crop of barley. In fact, on all his heavy land he would go on growing wheat crops until the land became foul, when he would take as a cleaning crop vetches. Every year he sold off his clover, hay, straw, but nevertheless made a very fair profit—not an extravagant one, but still, by being his own landlord, by being allowed to do what he thought best and in cost judicious, and by having sufficient capital to farm his land well, he realized about £2 an acre. This was no mere theory, because he would give them the returns for several years past. He found that in 1868, Mr. Prout realized by the sale of his crops off about 130 acres of land, £1,726; in 1869, £3,233, in 1870, £4,600; in 1872, £4,743; in 1873, £4,570; in 1874, £4,028; in 1875, £1,518, in 1876, £4,672, and in 1877, 4,451. It would therefore be seen that, notwithstanding the fact of low prices, somehow or other he had succeeded in obtaining the same returns. Hence, if the price of wheat went down, and his returns continued the same, it was to be inferred that he had grown more wheat. And the land, too, was in no worse condition than when he commenced. Indeed he (Mr. Voelcker) had recently examined the soil, and found that if anything, the land was in a better agricultural condition, and he believed that if it were brought into the market at the present time, it would realize more than double what Mr. Prout gave for it. In 1875 the land was valued by a very competent surveyor at £31,000, and now he might venture to say that it was worth £2,000 more, whereas Mr. Prout purchased it for £16,000. In fact, the land was in a better agricultural condition than it was a few years ago. Even last season, which was admittedly a bad one, his sales, exclusive of his clover crop, amounted to £3,820-15s. His wheat averages were £10-2s.-7d. an acre, barley, £9-1s.-6d., and oats, £8-12s.-6d., making his total grain average £9-15s.-3d., which was not bad for the last season. Taking into account the clover crop, and also about 14 acres of tare hay, the whole value of the produce in 1878 was, it was estimated, £1,719. Making allowances for various contingencies he estimated the value of the produce in 1878 at about £4,500 which gave him an average of about £10. The cost of cultivation, including the manure—which, as he had said, amounted to from £2 to £2-10 per acre—was about £8 an acre, so that upon his 450 acres Mr. Prout made a

clear profit of £900. He had merely mentioned this matter as an instance of successful farming—rather peculiar farming, and which he admitted could not be practised everywhere, but which illustrated very forcibly the great advantage of farming when a man was his own landlord, when he had intelligence, when he had capital, and when he had the security that whatever he laid out upon his land would not be taken by another that followed him. He had not in any way exhausted this almost inexhaustible subject of the fertility and improvement of land. There were many means of improving land; but, in conclusion, he would say that what he wanted to impress upon them more especially was this—that it was impossible for a farmer to compete successfully with foreign producers if he followed mere routine practice, and did not take advantage of the lessons which modern science and which sound commercial principles inculcated, or ought to inculcate, upon the agricultural mind—(applause).

NATIVE IRRIGATION.

THE following article from the *Pioneer* graphically pourtrays the imperfections of native irrigation works, and their costliness even when made on really scientific principles.

Ali Mardan Khan may fairly be regarded as the father of canal irrigation in Upper India. His great work was the Ganges Canal, subsequently revised and completed by the British Government, and reviewed by the Sanitary Commissioner. Numbers of people, however, who have become acquainted with the great canal in Dr. Planck's picturesque pages, may be unaware of the existence of similar systems of irrigation all over the country, conducted with private capital according to traditional native methods. Of course, it is not every river that will answer the purpose. The resources of an empire, whether Moghul or British, were needed to draw canals from the two great rivers of the Doab; and many of their affluents, though of comparatively inconsiderable size, are beyond the control of private means, because they have no well-defined channels, but persist in wandering at their own sweet will through sandy wastes. Masonry dams or even rubble weirs, are no light matter in a country which does not produce a stone to throw at a dog; especially when the river has to be kept well in hand, and brought up to the obstacle properly, or it will refuse the leap, and go shying off into the drifting desert on either side. Thus it often happens that streams, tractable enough as regards the volume of water, and flowing through rough thirsty tracts, proclaim themselves as useless for irrigation by the gleam of white sandhills from afar. But there are others of a more kindly nature, flowing between unmistakable banks of solid earth, bordered with trees, dispensing shade and greenness instead of barren glare. It is these which are turned to account by the agriculturist, to bring the beloved water to his crops. With amateur engineering, and levels worked out by rule of thumb, he will contrive a system of water channels which, when in full operation, shall protect the harvests of fifty villages. Unfortunately, its operation is very uncertain, from variety of causes, and the result not unfrequently is that villages assessed at irrigation rates, are in want of water every other year.

To begin with, the dam is a great trouble. A stone weir, such has one commonly sees above watermills at home, is effectually prohibited by nature. A brick weir would be far too expensive. The only alternative is an embankment of earth. This, again, cannot be made everywhere; one has to choose a spot where the soil contains a maximum of clay and a minimum of sand; and then, with plenty of straw and a fair proportion of "ladies" in the centre of the bed (such is the the native name for the equivalent of what the military mind would call fascines) one may hope to build a dam which will hold up many goodly feet of water through the scorching months. But in order that the water may gather head, it is needful that the dam be built immediately after the close of the rains. That would be a sufficiently simple matter, is the building of it were any one man's business, and if that man had no lack of capital and public spirit for the job. In reality, these dams are usually the joint property of the landlords of several adjacent villages, most of whom are impecunious, and every one of whom is quite willing to leave the initiative to all the others. If there is a man of means and energy among them, he is regarded with suspicion, as desirous to deprive his partners of their immemorial rights. These rights, again, are too often of very uncertain value. They are commonly of the nature of dues from all the villages receiving water from the dam, or the sharers are entitled to free labour from those villages in building and repairing it; but in practice neither the rupees nor the men are given with any regularity. There is, in fact, no obvious method of enforcing rights like these. The revenue courts cannot in strict legality take cognizance of them, and the civil courts are expensive and ill-adapted to such causes. Uncertain and indefinite as they are, however, their possessors cleave to them jealously; and any attempt to interfere with them is sure to cause trouble. When at last all difficulties have been removed, when the *vis inertiæ* of the native character has been overcome, and the committee have resolved to make a beginning of their dam, fresh grounds of debate are sure to arise in the course of the work as regards the quantity of earth to be contributed by each member. One man is to undertake one end, his partner the other, while two more divide between them the two slopes of the middle bank, and all are bound to lay on their due proportion of earth, as measured by the square wells in the dry bed where the necessary excavations are made. All this causes delay, and does not tend to increase the solidity of the work. Sometimes the dam will be scamped with light soil instead of clay, and the tail of the rains will sweep it away, leaving the committee too exhausted or too disgusted to build another. But supposing that they have gone honestly and zealously to work, and that a good strong dam crosses the river-bed, and defies casual floods—there still remains the question of the water which should be behind it. The dam may be admirably calculated to stop every drop of water that reaches it; but this quality cannot well be tested if all the water in the river has been stopped already by a dam higher up. In fact, the villages all along the banks shew their appreciation of a stream of this kind by damming it every four or five miles; and though there is plenty of water for all the dams, if they are only made in time, yet when the business is postponed, the odds are increasingly in favour of the villages higher up the stream as against those below. There are, indeed, recorded stipulations by which every dam is entitled to draw upon the dam above it; but in a late season it is more than doubtful whether such drafts will not be dishonoured. A liberal discount in the shape of cash down, is not unfrequently demanded in such circumstances; and illegal as the claim is, the wiser course often is to comply and save the harvest. There is not always time to await the result of a reference to the revenue court; much delay is involved in the calling for reports and the recording of evidence; and after all, the conclusion arrived at is likely enough to be in favour of maintaining the *status quo*, for the letting out of water has been a dangerous business since the days of Solomon. An inspection of the river would clear up all doubtful points; but every one acquainted with district work knows that it is not always possible for an officer to visit a given spot at a given time.

Postulating the dam in the first place, and the water behind in the second, there remain the questions of the temporary distribution and final disposal of the precious. It is surprising what a quantity of water one of these dams will hold up. Below is the river, deep sunk between its banks; above is a little lake of clear water, reflecting every tree on its borders, and making a fair and cheerful prospect far and wide. But be the prospect never so wide, the people of the watered villages will wish it wider. They are always crying "more, oh more, we are thirsty yet!" They lament the good old days when the water was up to a man's waist in their streets. They are eternally pointing out impossible altitudes as the regular recorded flood level. At the same time, they do not take the slightest pains to expedite the raising of the level by confining the stream, or by giving a scientific frontier to their watery possessions. Their object is simply to accumulate as much as they can, regardless of the fact that the more distant villages are vainly waiting for their channels to be filled, while the water which should rise and replenish them is wasting itself in holes and backwaters spreading laterally instead of rising vertically, and adding square yards to its surface, instead of the few all-important inches to its depth. And when the channels do begin to fill the water is checked in its course by a variety of impediments. The main arteries are merely natural creeks twisting about in the lovely fashion peculiar to the Indian nullah, and deep enough to swallow up a small river before a drop can reach the fields. The channels made by man possess indeed the main virtue of being true to their levels, but they are too commonly choked, and even when in the best repair, it is part of their original plan to expand into lakes every quarter of a mile or so, each of which takes a couple of days to fill, and when filled is of no particular service, except as a wallowing place for the buffaloes. So much for the distribution, from which it is easy to see how much chance the outlying villages have of getting water, when quarrels or carelessness have delayed the building of the dam. The final disposal of the water involves some points which carry us back to the beginning. The most elementary acquaintance with practical hydrostatics will enable one to grasp the fact that an earthen dam in the rains must do one of two things,—it must either hold the water up, or break. Overflow is impossible. Generally speaking, the dam breaks, because it has not had money enough spent on it to stand the increased pressure. But it would be rash to infer that this restores matters to their pristine state, and that the cycle of dam-building, dam-keeping, and dam-breaking can commence *de novo*. On the contrary, the released river usually revenges itself upon its gaolers by scooping a huge hole under its prison wall, which effectually prevents any similar structure next year upon the same foundations. In this way, in the course of a dozen years, the dam will be gradually driven down the stream, leaving a wilderness of holes, excavations, and remnants of old banks, in which the water, coming down from above, may waste itself at pleasure. These accidents might be avoided if the centre of the dam were based upon a solid foundation of good puddled clay, with rubble over it, extending as an apron on either side for some yards; but such an expedient is out of the range of native foresight. The other plan is to build a dam which shall not break; and sometimes if the rains are reasonable, this will succeed for as many as seven years together. Of course, escape-channels must be provided at the sides, and these, unfortunately, have a habit of usurping the rights of the river, which finds itself some fine morning high and dry, while the treacherous escape channel has marched off with all the water, and is announcing itself to the country-side as the original river out on tour. When the next dam comes to be built, a new site must be chosen, and the riparian villages will have to lament so many acres of land cut up and thrown out of cultivation.

One would like to point a moral from all this. The most obvious moral is the uselessness of expecting from the natives of India either continuity of purposes, or unity of action, or expenditure on distant objects. If these people will not exercise ordinary care and prudence in using the gifts of Nature, they must suffer for it. If a settlement at irrigation rates is not enough to remind them that they must provide water for their fields, it is their own look-out. Nevertheless, something might be done for them in the way of instruction. It would cost canal officers little trouble to make themselves acquainted with the

systems of their native rivals, and they might often be able to give valuable advice which, backed, if necessary, by the collector's order, would make all secure for the present and prevent misdirected labour and expenditure in the future. Again, it might be found that the landowners concerned, or at least some of them when enlightened as to their real interests, would be willing to make an effort towards placing the whole system on a satisfactory basis once for all, by building a masonry weir or dam with spacious sluices for the flood waterway. The cost is of course the great impediment; but there are rules under the Land Improvement Act, which could not be more usefully applied than to cases of this kind. The advantage of the canal officer's advice in this respect would be two-fold;—the zemindars would get a rough estimate of the extreme cost, and they would have the way smoothed for their application for assistance under the Act. All this could be managed by a couple of visits to the spot in the court, of a year. Meanwhile, the matter would be kept in notice for future occasions, and especially against the contingency of future famine. Nothing could be more suitable for the employment of famine labour than works of this kind. They would be close to the labourers' homes. They would furnish work to many hundreds for several months; for besides the building of the dam, and the rectification of the wasteful gulfs behind it, there would be many miles of straight orderly conduits to be dug, in the place of the present tortuous and haphazard channels. To one and all concerned, it would be a labour of love. Not the meanest basket-bearer but would understand and appreciate the value of the work. The quantity done would admit of the strictest measurement, and the work would remain useful for ever, for if the Indian labourer has any glimmering of science, it is in the matter of levels and watercourses. Much might be saved in supervision, for once the lines were marked out by the engineer, the zemindar could safely be trusted to see that the work was not scamped, and thus the principle of local action could be enforced. Local responsibility might also be insisted on, at least to ascertain extent, by making the zemindars contribute a portion of the expenses, whether by immediate payment or by annual instalments upon the revenue. The point is one worth bearing in mind against years to come. It would be an improvement to substitute anything for the plan of throwing shovelfuls of earth by the roadside, or, as has despairingly been suggested in some quarters, digging a great hole, and filling it up again until prices mend.—*Ceylon Observer.*

NAGPORE MODEL FARM.

HALF YEARLY REPORT.

(By Captain F. B. Morris, Superintendent)

THE farm, it is known comprises some 460 acres; but the whole of this area has not this year been retained in our hands and cultivated. Sixteen fields containing 127 acres have been leased out to cultivators. The soil of these fields is a very shallow black, with out crops of moorum; they will bear only the very lightest of crops; they are at a distance from the steading and the more important parts of the farm; and as the farm has only 15 pairs of cattle, the farm lands were too extensive to permit of all being well and deeply cultivated. It was therefore determined to leave out these fields and concentrate attention on the remainder of the farm. The Chief Commissioner was good enough to sanction the proposal. It may be remarked that in 1873-74, these fields were also let out to cultivators from whom an average rent of Re. 1 per acre was obtained. Since then these fields have been deep ploughed, and the consequence is that cultivators have been most anxious to obtain them. An average rent exceeding Rs. 1-10-0 per acre has been obtained, and some of the fields are rented at more than Rs 3 per acre. These rents greatly exceed the rent for land of similar quality in the neighbourhood, and they prove that the cultivators clearly see the advantage of deep ploughing. That they do not practice it themselves they explain by pleading their poverty, and the weakness of their cattle. The fact is they do not care to take the trouble.

The fields on the farm too which have not yet been completely levelled suffered also greatly from scouring. Certainly the monsoon was not favourable to the kharif crops. Some sowings were completely washed away and a luxuriant crop of weeds choked others. Cotton and jawari chiefly suffered. In the surrounding country the results of the continuous, and heavy rain were the same. The cotton crop it is estimated will not exceed a 6 anna one, and the jawari a 12 anna one, at the most. On high lands the jowari is better, but in the best lands the weeds sprang up so rankly, and the continued rain so long prevented all attempts at weeding that the cultivators in many cases finally abandoned all thought of weeding in despair, and many fields look as if the weeds were the natural crop, and the jawari a fortuitous growth. In another way the late rains prevented the preparation of the soil for the rabi crops, and the fields were very late prepared and late sown. In fact some fields put under wheat were not sown till the beginning of December.

In all, about 210 acres are devoted to what is called the commercial farm; that portion in which ordinary crops are grown in the ordinary manner, but with greater care than is the practice with ordinary ryots. Of this area, about 102 were put under kharif crops, and the remainder under rabi. To take the kharif first. About 21 acres were put under Hinganghat cotton, and 60 acres under jawari; the other fields being sown with tur. All these fields have at some time during the last 5 years been deep ploughed—so the soil has been well turned over. They were this year prepared for the kharif sowings by being well 'bakared'* in June, and the beginning of July. By the 17th July, all the fields were sown down, and it was fortunate that that was accomplished so early, for the rain when it did come down in July was against field operations. But the cotton fields could not stand the heavy and continuous rain. They lie sloping northwards the water scoured over the soil, and not finding an outlet turned the fields into a morass; the excessive damp killed the young plants; one after another they pined and died. Two out of the three fields under cotton were, on the utter failure of the crop, again ploughed out, and prepared for linseed in September, the sowings being completed in October.

One or two of the fields under jawari which greatly absorb moisture also suffered from excessive damp. As already mentioned the heavy and continuous rain prevented hoeing and weeding, the result being a poor crop.

The other fields under khatif crops did fairly well, still they too suffered from want of hoeing and weedings at the proper time, and from the absence of sunshine. When the weather cleared at the end of August and beginning of September, there was so much work on hand that the lost time could not be made up for. What could be done in the way of weeding while also preparing the fields for the rabi, was done; but on the whole only fair crops can be expected. The 'tur' promised very well until cloudy weather in October did some damage bringing out caterpillars, but a change of weather occurring about the middle of November, the plants picked up again and the weather since has been very favourable. The mode in which these crops have been cultivated does not differ materially from the native methods. The 'bakur' used on the fields is, however, somewhat superior to the ordinary native one, and more attention is paid to hoeing and weeding. Sowing is done somewhat earlier than the ryots are accustomed to and in the sowing of jawari a superior seed-drill is made use of. It leaves the seed somewhat nearer the surface and enables it to come up earlier. The amount of seed sowed, per acre, is also very much less than with native cultivators. Only 9 lbs. are used to their 40 lbs.

In sowing cotton too less seed is used than by the ryots, about 12 lbs. to their 16. The 'dhaoras'* used also of a superior make.

In sowing 'tur,' advantage is taken of a drill, which has four drills in a line each 18 inches apart, and by that means the seed is much more rapidly put in. In other respects, however, innovation has not been attempted.

Of the area under rabi sowings,—15 acres were sown with linseed,—17 with gram and 45 with wheat.

The fields could not be got at properly till September, when they were turned up with the English horse hoe, and by the middle of October most of the early rabi fields were ready. The linseed was at once drilled in. Unfortunately rain came down on the 21st and 22nd of that month, preventing further sowing and sweeping away the young seedlings that had come up. The fields had to be re-sown. The re-sowing was completed by the 1st November, and the crop promises well, gram was put in at the same time as linseed and is also doing well, though in the beginning of November the cloudy weather was somewhat against the plants.

The wheat sowings were got in between the 12th and 21st November, a late date, but this season unavoidably so. Fortunately the seed has come up well and the fields promise well. Besides a more careful preparation of the land, there is this difference between the native treatment of these crops and that pursued on the farm,—that the amount of seed sown per acre both in the case of wheat and linseed is considerably less than the ryots sow; in the case of wheat, 40 lbs. to their 80 lbs. or more; in the case of linseed 9 lbs. to their 18 or 20 lbs. The seed drills are also somewhat heavier, and the sowing is somewhat deeper. In the case of gram on the other hand a somewhat larger quantity of seed is used.

The present weather is very favorable to the rabi crops, and if it continues a good harvest may be expected.

I turn now to the fields in the Experimental Farm.

In fields No. 6 an acre planted last year with arrowroot is under jawari 'ganari,'† the field was manured in the previous year and was deep ploughed. The jawari was sown on the 20th July, and it promises to turn out exceedingly well: this portion of the field is well levelled and the manuring and deep ploughing naturally tell.

Another acre on which ginger was grown in the preceding year was put under Hinganghat cotton, the seed being sown on the 29th June after careful preparation of the soil; but whether it be the result of the season which has been so very unfavourable to cotton, or of the exhausting nature of the ginger, the cotton crop is poor.

A third acre in this fields was put under 'Jugdam'‡ jawari succeeding cotton. The land was 'bakared' and the sowing favourably completed; but the plot is not quite level and part of the seed was washed away.

Another field No. 8 was deep ploughed and 'bakared' and sown with jawari; but the heavy rain washed away great part of the seed and the outturn will not be good.

In field No. 9, 1 acre under peas in the preceding year was levelled and manured, and after careful preparation was put under chinur § 'dhan. The crop got on well till the end of August, but the September rain levelled the whole field and the outturn was consequently not good. It is possible that the 'dhan' should be put out later in the season.

A second acre which had been under Guinea grass was devoted to Carolina rice. By the end of July, it was seen that the young plants were languishing, and a top dressing of cowdung manure was applied. The

* Prepared with the "bakar," a kind of harrow.

* 'Dhaora', Indian hoe.

† Ganari' meaning sweet, a superior kind of jawari

‡'Jugdam', universal or common, an inferior kind of jawari

§ Dhan, rice.

monsoon rain however appeared to be too much for this crop, and the yield was below the average. Subsequently this acre was in October, after the rice was harvested, top dressed with cowdung manure, cultivated with the horse hoe and well 'bakared' and sown with lucerne grass of which the seed was got from England. The seed was got in by the 21st November; it germinated well and the grass is doing well under irrigation.

The acre on which the crop of chumur 'dhan' had been taken, was also in November ploughed up with the English plough, well 'bakared.' Sewage manure was applied and turned up with the ridge plough. Garlic and onions are being put down.

Two acres were levelled and manured and ploughed up with the English plough during April and May,—and as soon as the monsoon set in, planted with Guinea grass,—a top dressing of sewage manure as being applied and the plants are healthy and promise well.

One more acre ploughed and manured during April and May was again ploughed and manured in November, and has been under Guinea grass also, but in this case the ridge plough has been used so as to try the ridging system.

In field No. 10 there are 3 acres of sugarcane, two acres of ginger and 1½ acres of turmeric, the field had been carefully ploughed and manured. The sugarcane was planted somewhat late, the planting not being finished till the middle of April, and the plants suffered from the great heat of May and June and the very heavy monsoon. Caterpillars too did some damage and the result of all is that the crop is only a fair one. The ginger and turmeric failed because of the very great moisture.

In field No. 11 an experiment with Indian corn, and one with Banni cotton both failed, perhaps because the crop followed too quickly on sugarcane which had been taken from the land.

A small experiment with Rhea was not very satisfactory.

A considerable portion of this field is devoted to experiments with rabi crops. Part of the plot on which Indian corn was tried was on the failure of that crop again ploughed up with the English plough, manured with cowdung manure and wood-ash, turned up with the ridge plough and planted out with potatoes in the latter part of November. These promise to come up. Another half acre was after being ploughed and manured, divided into beds and sown with Italian red clover. The seed was imported from England, but it has not germinated properly.

One acre after being ploughed and manured in April and May, was again in October gone over with the horse hoe, top dressed with cowdung manure and sown in November with indigenous wheat. The seed was selected from the best samples obtainable in the bazar and the field promises well. Another acre having been similarly treated has been sown with English wheat. Half the field has been irrigated and the other left unirrigated but the seed would appear to have been poor, it has not germinated properly.

Another small experiment with potatoes in field No 17, failed.

Fields, Nos. 17, 20, 23 and 21, which are not suitable for cultivation have been turned into a forest plantation. Some seedlings were planted out, and seeds of various kinds sown. Some have come out—the experiment has just begun.

In fields 35 and 37 two acres have been planted with oranges and plantains which are treated in the ordinary manner. They are coming on well.

The foregoing remarks show what has been going on at the farm during the last six months—what crops are being grown, and what experiments have been tried. At this time the kharif crops have not yet been reaped, the actual outturn cannot therefore be given and statement regarding them must lack precision.

A DISCOVERY IN SUGAR.

IF statements embodied in a report by the English Secretary of Legation at Washington on 'Sugar Production in the United States" which has just been issued as a Parliamentary paper, come to be verified in actual experience, the sugar trade of the world is likely to undergo some very important changes during the next few years. The consumption of sugar in the United States is very great in 1876, a year when severe commercial depression had reduced it considerably below the average of the previous three or four years, the total consumption was close upon 1,430 millions of lbs. in addition to nearly 49,000,000 gallons of molasses. Of this enormous quantity of sweet stuff, more than 1,277 million lbs., or nearly 88 per cent., was imported, and it may therefore be said that practically the United States are at present dependent for their sugar supplies on foreign countries. The great bulk of the imported sugar—about eighty per cent., or just over a thousand million lbs. —comes from Cuba: the rest is obtained, in much smaller and comparatively insignificant quantities, from Porto Rico, other Spanish possessions, the French, Dutch, and British West Indies, Brazil, British Guiana, and the Sandwich Islands. The average value of the annual import of sugar into the States during the past few years has been nearly £17,000,000 sterling—that is including the duties imposed by the American Government, which form a considerable proportion of the total sum. These facts and figures indicate that the United States are among the largest consumers of sugar in the world.

It is only natural that a nation which possesses so vast a territory, presenting such varied climatic conditions, should endeavour to produce for itself an article of such primary importance as sugar. Attempts of this kind have been made in different parts of the Union for a long time back and have not been unattended with success. In 1861-2, the production of cane-sugar in Louisiana was more than 500 million lbs. and reached, in fact, to considerably above one-third of the total consumption. But this extensive industry sustained a terrible blow during the war, and its recovery has since been so slow that in 1876-7 the production was under 200 million lbs., or barely 12 per cent. of the total consumption. Various reasons exist for doubting whether it will ever be restored to its former dimensions. The true sugar-cane, *arundo saccharifera*, the plant which is cultivated in Louisiana, is only indigenous in strictly tropical regions, and the narrow fringe of territory on the Gulf coast, where alone it will grow at all, is extra-tropical. Although fresh cuttings were continually imported, and nothing that human skill and enterprise could effect was neglected, the sugar-cane has never been really acclimatised in Louisiana, and has invariably and rapidly deteriorated. Moreover, a large area of the best sugar-growing lands in the State is exposed to the annual inundations of the Mississippi. Hundreds of thousands of acres of such lands are said to be at present lying waste through the breaking of the levee, and it has been practically proved that resources of the planters, and even of the State itself, are not equal to the task of constructing embankments which will permanently keep the river within its proper bounds. Thus sugar-culture in Louisiana must always be carried on under conditions of difficulty and expense, which will act as effectual limitations to its developement. Attempts have been made in various parts of the Union to produce beet-sugar, and much capital and effort have been expended in this way, but thus far it has not been found possible to obtain beet sugar of good quality, and in sufficient quantity, and at sufficiently low cost, to take the place of the imported sugars produced from the tropical cane. Furthermore, beet can only be grown for sugar in the Middle and Northern States, and will, it is said, "only yield sugar remuneratively where the summer rainfall is equal to that of spring, and the natural peculiarities are not unfavourable."

But recently a discovery has been made by a Mr. Stewart, of Murraysville, Pennsylvania—who has devoted his attention for some years to the chemistry of saccharine juices—which, if it be verified in practical experience, will in all probability convert the United States from an importer into an exporter of sugar. This discovery is nothing less than the fact that excellent sugar can be obtained from the stalks of maize or Indian corn, and from sorghum, or Chinese sugar millet. Maize, it is scarcely necessary to say, is one of the chief agricultural products of the United States: it is brought there to greater perfection than anywhere else in the world; it can be reared in almost every State of the Union, and the yield, especially in some of the rich prairie soils of the Western States, is so enormous that stalks and grain have often been used as fuel because there was no means of profitably disposing of them otherwise. The sorghum, which has been acclimatised in America for nearly twenty years, is a still hardier plant than maize, and Mr. Stewart says that "the climate of the whole territory of the United States south of Alaska, where the soil is not barren and the moisture insufficient during the summer months, is adapted in various degrees to its growth." Thus the chief obstacle which has always stood in the way of the economic culture of the sugar-cane in Louisiana does not exist in regard to either maize or sorghum. Again while the sugar-cane has to be propagated by cuttings, both maize and sorghum are propagated by seed, which can of course be grown at a comparatively insignificant cost, and in both the juices mature in a much shorter period than in the case of the true sugar-cane. What is known as "starch-sugar"—a very different and greatly inferior substance to crystallised sugar—has been obtained from maize for some years past, and an inferior kind of sugar has been extracted from sorghum in China from a very remote period; but from neither plant had a sugar which could compete commercially with the product of the *arundo saccharifera* been obtained before Mr. Stewart undertook the scientific investigation of the subject. The result of that gentleman's experiments, which have been carried on with great care and completeness for two years, is to show that crystallised sugar, equal in quality to the best that is imported into the United States, can be obtained from both sorghum and maize in large quantities. Mr. Stewart puts the average yield at 1,800 lbs. of sugar and 41 gallons of molasses per acre; but with careful cultivation and judicious manuring, he is of opinion that 2,000 lbs. of sugar and 66 gallons of molasses per acre might be obtained. Besides this there is to be taken into account the green grain of each plant, and a large yield of green fodder, while the refuse of the manufacture will suffice, if returned to the soil, to keep it in good condition. The process of manufacture, which Mr. Stewart has explained in detail—reserving only for the present the secret of the chemical process which has made it successful—is more simple than that employed in the case of the true sugar-cane, and much more economical than that which is necessary to extract sugar from beet.

The practical value of Mr. Stewart's discovery and the accuracy of his statements seem to be beyond question. Mr Drummond, our Secretary of Legation at Washington, whose report on the subject embodies the facts given above, says he has tasted sugar extracted from corn stalks, and that "it is very sweet and well crystallised." He also mentions that a farmer in Maine having made some experiments in sugar production from maize, estimates that the yield of sugar from one acre of that cereal will give as much profit as the produce of thirty acres of wheat. Even supposing that this is too sanguine an estimate

it is still evident that a new productive industry of enormous value and importance has been brought within the reach of American agriculturists. Mr. Stewart calculates that two per cent. of the area now devoted to the cultivation of maize will be sufficient to supply the whole home demand of the United States for sugar. If this calculation at all approaches correctness, it may reasonably be anticipated that in very few years foreign producers will no longer find a market for their sugar in America; and even if the maize and sorghum sugar is not found capable of competing in the European market with cane sugar, the diversion to that market of the large quantities heretofore consumed in the United States must have the effect of greatly reducing the cost of the article to the consumer. As to the consequences of the new discovery on the beet-sugar industries which have been laboriously built up in France, Belgium, and Germany, on rather artificial foundations, it is perhaps premature to speculate. But it may be worth while to remember that maize can be grown in Southern France, in Italy, and in other parts of Europe, and, moreover, that it is indigenous in India; and if the new process proves as successful as it is said to be, there is no reason why its application should be confined to the United States.

BARRON'S TRANSPLANTING MACHINE.

THESE machines were originally invented by Mr. William Barron (of the firm of W. Barron and Son, landscape gardeners and nurserymen, Elvaston Nurseries, Borrowash, Derby) in the year 1831, then and for many years gardener to Charles, the fourth Earl of Harrington, and for whom he laid out the extensive and unique grounds at Elvaston Castle. It was by the aid of these machines that the wonderful effects were there produced in an incredibly short space of time, which afterwards became the admiration of all who had an opportunity of visiting the gardens at Elvaston. The first trees operated upon were four large cedars of Lebanon, and the following table will give the respective dimensions of each when first transplanted until 1871, which was the last time they were measured.

Date of removal.			Height.	Circumference of stem.		Height.	Circumference of stem.
Feb.	1831	No. 1	28 ft.	4 ft.	1871	77 ft. 10 in.	7 ft. 2 in.
"	"	" 2	32 ft.	3 ft.		81 ft. 8 in.	9 ft. 8 in.
"	"	" 3	35 ft.	8 ft.		76 ft. 4 in.	9 ft. 6 in.
Nov.	"	" 4	33 ft.	6 ft.		58 ft. 10 in.	9 ft. 9 in.

It may be asked why Nos. 1 and 4 did not increase in the same ratio as Nos. 2 and 3. The cause is easily explained, *viz.*,—No. 1 was planted on the south side of the grand avenue, which runs from west to east, and was shaded by tall trees; Nos. 2 and 3 were planted on the north side of the same avenue, consequently they were fully exposed to solar action; No. 4, after it had been planted a few years (in consequence of surrounding objects), had its branches foreshortened several feet (its branches being fifty feet diameter); thus the want of solar action in No. 1, and the shortening of the branches in No. 4, materially lessened their elaborating powers. From November, 1831, up to March, 1851 (when the demise of the fourth Earl of Harrington caused such operations to cease for a time), many hundreds of large trees, some of great age and size, both deciduous and evergreen, were brought from surrounding counties from ten to thirty miles, and with uniform success.

For the last twenty-five years Messrs. Barron and Son have kept a number of these machines, of six different sizes, for hire, which they send out with one or two experienced men, according to the size of the machine required, at a fixed charge per day. They have been employed in almost every county in England; in Wales Scotland, Ireland, and on the Continent. A remarkable example of a tree moved under great disadvantages may be seen at Swithland, near Leicester. This tree, a large Scotch fir, fifty feet high, was removed in July, 1868. It was seen by thousands of visitors who attended the Royal Agricultural and Horticultural Societies' Shows, when they were held conjointly at that time at Leicester. It was brought upon a No. 2 machine a distance of eight miles into the show yard the week before the show, and stood there the whole of the show week following; it was again removed five miles and planted. It still lives and thrives, after being *eleven days* upon the machine, exposed to a cloudless sky and a broiling sun during the whole of the time. Numerous other examples may be seen at Millichope Park, Shropshire; Lockley, Welwyn, Herts; Drayton Manor, Tamworth; Dorfold Hall, Cheshire; Whitbourne Hall, Worcestershire; Winslade, near Exeter; Crofthead, near Glasgow; Lower Grounds, Aston Park, Birmingham; the Royal Botanic Gardens, Kew; and at many other places of note too numerous to mention.

A tree being about to be lifted, say forty or fifty feet high, the diameter of branches will about determine how far it will be necessary to trace the roots, which must be carefully denuded of soil up to the size of the mass of soil to be removed, say ten feet by nine. Under this ball and under the centre of the tree a drift must be made two feet wide under all the roots; this being done, two sets of best 3 in. red deal planks, 11 in. wide, must be passed through, standing not less than 9 in. beyond the ball at each end. Resting on these at each end an end plank of the same strength, with one of the top edges bevelled, must be passed under the ball; that done, two more side planks must be introduced under all the roots, these to rest at each end of the end planks. By this means the tree, with its large mass on soil and all the roots within remain undisturbed, the machine being then put to the tree, it is then raised by strong rollers at each end by means of lever bars and ratchet wheel; these are placed across the trussed beams of the machine. Should guy ropes be necessary, which they will be if the tree be tall and have a heavy top, they should be put on before the centre drift is made. On each roller is fastened the two ends of strong tar rope, capable of bearing more than half the weight of the tree. After it is raised, strong chains, suspended from the beams, are passed under the centre planks at each end to carry the whole weight, also four corner chains, suspended from the beams, are fastened to the four corners where the side and end planks cross each other. By this means the tree is kept steadily in its erect position.

When the tree reaches its destination great care must be observed in getting the under planking out without breaking the ball of earth or otherwise injuring the roots. It will always pay in having large trees removed to have an experienced man to conduct operations, otherwise failures may be expected.

Trees of immense size, far too large for any machine, have been transplanted most successfully by this firm, under Mr. Barron's personal superintendence. In several counties (*e. g.*, in Kent) trees weighing about thirty tons have been transplanted; in Surrey, in the latter end of July and the first week in August, just when in an active state of growth two remarkable cedars of Lebanon were removed a considerable distance and transplanted; both are growing as if they had never been removed. One was over 50 ft. high, circumference of stem 6 ft. 10½ in., and weighed over fifty tons. The largest one was over sixty tons, and of the following dimensions.—Height, 47 ft. 6 in.; diameter of branches, 59 ft.; circumference of stem, 11 ft. 6 in., and at 4 ft. 8 in.; above ground it was 10 ft. 9 in. The solid mass of soil removed with the tree was 18 ft. long, 15 ft. 6 in. wide, and 3 ft. 7½ in. deep. The whole was taken up an inclined plane one in eleven, carried on rollers, and moved by powerful machinery.

FRENCH AGRICULTURE.

FRENCH agriculturists are divided upon, and becoming somewhat distracted about, the question of free trade *versus* protection. In certain regions of France, the price of wheat varies fr. 18 to 22; consequently it no longer pays to cultivate grain at this price. It is also a truth, that putting a tax on American corn—for the States supply two-thirds of that imported—will not remedy the evil, for foreign grain, owing to expenses of production, &c., being less, could still successfully compete with home grown, also with grain and if a tax was levied, the consumer would have to pay dearer for his bread, and the proceeds of the impost would go, not into the pockets of farmers, but into the coffers of the State. If the culture of wheat does not pay, farmers must try the production of meat, but above all, pursue more advanced systems of tillage, notably the usage of commercial manures, irrigation and the employment of machinery: the latter is more than ever necessary at present, when the population tends to emigrate to the manufacturing centres, attracted by higher wages. France has not much more than commenced to lay in her necessary supply of agricultural implements. In order to encourage the extensive use of machinery, workshops, with able mechanics, are to be organised to be ready to execute repairs.

M. Goffart, the discoverer of conserved green forage for stock, is in the habit of publishing annually a statement of his experiences; this year his remarks are not less valuable, because they are an exception to an interrupted success, the system has not been at fault, but the experiment has suffered from bad weather and questionable seed. His neighbours are not more fortunate. While 40 tons per acre of green maize were yielded, in some cases not twelve were obtained. This latter return is simply ruinous when the heavy expenses of tillage and manure are borne in mind. The choicest seed maize comes from Nicaragua; but it never arrives in time, and is injured generally by the weevil. New York supplies the next best seed, provided it be transported in barrels, to avoid heating; failing both, the ordinary horse tooth maize is to be preferred. It is no longer a question that the best method to preserve, as well as to employ the forage, is to cut it before treading it into the trench or pit. A machine worked by hand is not to be thought of; a cutter driven by two horses ought to chaff the green maize at a cost of 6 sous per cwt., while an engine will do the work for two-thirds less. It has been ascertained, that a trench eight feet wide, and covered with earth, will lose 20 per cent. of its

contents, while the loss will be only nominal if the trench be made double the width. Another point to be noted; there is a growing disposition among farmers to employ nothing but this trench forage all the year round. Generally one man, at fr. 2½ per day wages, is allowed the care of twelve head of cattle, fed on beet, turnips, hay, &c., to cut the roots, and provender. M. Goffart requires only two men, at the same rate of wage, to take charge of eighty head of stock fed on the pit rations.

Dr. Estein, of Bonn, draws attention to some singular facts, connected with dairy stock, that is, regarding cows viewed as machines for transforming raw material food into milk. He lays down that the milk-yielding quality of cows is not peculiar to any race, so much as that the mean yield between breeds is different. A good milker may be common to any race. It appears that a M. de Kappen, near Paderborn, registers every fortnight the weight of each animal, and the quantity of milk it has yielded—testing thus the ratio between secretion and flesh. Now the digestive aptitude is proportional to the live weight, and the function of the mammiferous organs to the quantity of nutritive elements conveyed to them by the circulating blood. The average weight of thirty cows is 11½ cwts. and the daily yield of milk over 11¼ quarts, or 773 quarts per year, for every 2 cwts. of stock. Now one animal with a live weight of 11½ cwts. yielded 1,286 quarts of milk per 16 stones weight, while another of 13¼ cwts. gave but 398 quarts, per the 16 stones. Here the evidence is striking that the difference depends not on race, though the herd is Dutch, but on the formation of the mammiferous organs. Further the relation between the yield of milk and its richness augments with the abundance and superior quality of the ration; the appetite of the animal thus becomes the test. Now as it clearly requires more food to support an animal of 13¼ cwts. and yielding less milk than one of 11½ cwts., the latter must be the more remunerative machine for transforming food into milk.

Street sweepings form a manure of an uncertain importance, but in Paris, that which is produced in the vicinity of the markets is more valuable. At Dunkirk, the refuse of the streets is mixed with stable manure and sea-sand, the mass being daily wetted with urine and feculent matter; its wholesale price is frs. 2¼ per cubic yard or ton, the contractors re-selling it to farmers for frs. 4. As a general rule, not more than 50 per cent. of street manure is valuable. Professor Heinrich of Rostock, has experimented with six different kinds of nitrogenous manure on rye, the soil operated upon being deficient in azote. The same quantity of nitrogen given in spring to the several plots, under the form of fish, guano, powdered horn, blood, and nitrate of soda, have produced the same effect; but have been less efficacious, when in the form of sulphate of ammonia or powdered flesh. The influence of all the manures was excellent on the grain, thus contradicting a common belief that it is the straw which is influenced. When there is too much fat in an animal manure, its action is diminished. In the present experiments, nitrate of soda proved the best manure, and in addition, was the least costly. M Ladureau's experiments with flax are interesting; the most lucrative yield of flax is that from a manure uniting azote, phosphoric acid, and potash; the fibre, though not so abundant, will be of superior fineness. Nitrate of soda does not produce much effect, flax requires very little soda, but much potash, and it has not the power to replace, like beet and some other plants, potash by soda. In the north of France and in Belgium, the plan is therefore bad, which consists in dosing, more or less strongly, with farm-yard manure, guano, oil-cake, animal refuse, and similar nitrogenous manures, soils intended for flax. When the land is of ordinary richness, 2 or 4 cwts. of the salts of potash and of magnesia, sown in spring, will suffice.

It is anticipated that the new commercial treaties will give an impulse to the cultivation of hops in this country. France has about 9,000 acres under the crop, which sells at frs. 70 the cwt. Twenty years ago the price was from frs. 200 to frs. 400. Cabbage is liable to a well-known disease in the roots, called club root · it is not very general in France, but in the neighbourhood of St. Petersburgh, it is a veritable plague. M. Weronin has devoted three years to the study of this disease, which he calls "hernia"; it is produced by a microscopic parasites, and develops with greater rapidity in moist, than in dry soils; radishes and turnips are liable to be attacked by the parasites, which, quitting the excrescence in the root, seek refuge in the soil, till occasion offers to feed on another root, irrespective of age. Burning the diseased roots, and changing the crop for a few years, are the proposed remedies.

"REBOISEMENT."

Of the slipping in of the sides of ravines M. Théiu gives a graphic account in the French review. The undermining process, begun in times of heavy floods, often ends, he tells us, in embracing the entire slope of a mountain, and the pictures fully bear out his statement. The torrents of France, according to these authors, generally present three features: first, the cone of dejection, at the point of the egress of the stream from the mountains; secondly, the main channel of its course, which is usually in narrow ravines with high precipitous cliffs; and lastly, the catchment basin, where the cliffs open out and form a wide irregular amphitheatre. It is here that the waters collect which feed the stream, and it is upon the fact whether the slopes of this amphitheatre are clothed with woods or that depends the violence of the torrent in times of heavy rain or rapid thaws. If bare, the area simply forms an immense funnel which drains off the waters as they fall, and converts a watercourse into a raging river.

The operations proper to "reboisement" consist therefore, (1) of planting and grassing the slopes of the catchment basin, with subsidiary works to render the former possible and effective; (2) of direct impediments to the violence of torrents, in the shape of dams, piling, &c.

Especial pains appear to be taken with the planting. If the slopes on which the plantation is to be formed are irregular in appearance, and cut up by deep watercourses, the first thing done is to reduce them to a plane surface. A model is devoted to the illustration of this subject. The ridges are hacked down, and the hollows filled up, or propped with sustaining walls or piling. The slope generally is also supported with piling and fascine work. A favourite plan is to use truncheons of live wood for piles, and interwine them with willow branches fastened into the earth, thus producing a living fence. The ground may then be considered as ready, and the young trees are either planted or sown. In either case it is usual to sow grass seeds at the same time, in order to increase the stability of the soil and afford shelter to the young plants.

In the case of very steep ravines the ground is marked off in little terraces or stages inclined slightly inwards, in order to retain the water, and these are planted with trees on their outer edge. The trees are hard woods of two or three years of age, and are planted thickly, so as to touch one another. This method has been found perfectly effective in fixing such places. An improvement on it has lately been adopted in the case of the stiff lias clays, which are the most untractable of all the soils that the forester and engineer have to deal with. The plan is, instead of making a regular terrace or stage, to make but an incipient one, or mere edge. It is inclined inwards about two or three in ten, and faced off vertically on the upper side. The plants are then inserted as before in the groove thus formed, and covered with earth from the stage immediately above. This is termed the *cordon* system. It has the advantage of not requiring any pile-work to support it, and of not altering the appearance of the slopes, as in the terrace system. Slips from above are also less frequent when this method is employed, as the water is not liable to penetrate the ledges so much as in the case of the terraces. In the intervals between the lines of stages rich grooves are sown together with the seeds of coniferous trees.

Of the dams and other direct obstacles raised to avert floods it is hardly necessary to speak, save that they are of all kinds, from rustic work to finished masonry. That in the model of the Bourget torrent before us cost, we are told, £620. It is 23 ft. high and about 5 ft. 0 in. broad at the top.

THE FIBRES OF BURMA.

British Burma imports annually fibres of one kind or another, products of the vegetable animal kingdoms, together with their manufactures, to the value of about 5 million sterling. Of gunny bags alone, a million and a half are imported, besides raw silk and others. Considering the natural advantages of the place, this import trade is not a little anomalous. Few countries possess so many and different kinds of fibre-yielding plants as this one, and yet local trade is indebted to Bengal for jute and jute-fabrics, to India for cotton, and to a number of other places for fibres and textile manufactures. The genera of the vegetable kingdom famous for their yield of fibre exist here largely. On the highways, and byeways, in the jungle and the fields, such as *Sida, Urena, Hibiscus, Abutilon* abound. Rangoon and its suburbs can boast of a number of them, all growing wild. Notwithstanding this mine of vegetable wealth, little has been done for its development. Jute cultivation was tried some time back, but failed. The causes, however, for this are so well known, and easy of removal, that it is a reproach to local enterprize nothing has since been attempted in the line. But leaving jute out of the question as already noted, the country is rich in other varieties of fibres, and a visit to the Phayre Museum will convince the most sceptical on this point. The specimens there exhibited are all the yield of indigenous plants, and those chiefly of the Malvaceous order, the order to which the gaudy shoe-flower and purple-eye cotton belong. They are all cultivated with the greatest facility, and as readily propagated. With ordinary care and trouble, a field could be raised without much cost of time or attention, and to very great profit. The humble weed *Sida*, with its tiny, pale, orange bloom, to be met with on the sides of the dustiest roads, yields one of the toughest fibres in existence, and those from *Urena* and *Abutilon* are long, flowing, and glossy, like jute.

The members of the orders named have in addition this advantage—they arrive at maturity one after another at intervals sufficiently removed to permit of a field being worked up well after a growth before another is put down. In this way, with a little foresight and provision, produce might be obtained nearly all the year round, and the loss from keeping labor unemployed reduced to a minimum. The manipulation of fibres from most of these is neither difficult nor arduous; and all things considered, it does seem a very great pity

that such a promising source of natural wealth should, up to this day, remain undeveloped. The want of labor is accountable, before all others, for want of progress and improvement in this direction, just as it is accountable for the backward condition of most other local industries and manufactures. Indeed, the advance of the whole country is stayed on account of the poverty of the labor market. Until the labor-question is solved, there is no hope for profitable development of natural resources; and very little for the opening out of the country in general or the prosperity of its trade and manufactures. To be fair and truthful, however, it must be acknowledged the question has not been neglected by the local administration. Mr. Thompson, than whom a better revenue officer would be difficult to point to, saw and appreciated the difficulties in the way, and did not spare efforts to secure labor for the local markets. Unfortunately, however, for the country Mr. Thompson was not free to do as he liked. The ninteen lakhs of rupees given him during the Madras Famine, to utilise for purposes of State Immigration, were so restricted by conditions that from the outset, he saw little, if anything, would ever be got with the unusually liberal grant. Mr. Aitchison, who is more of a statesman, sees the difficulty in the matter as indeed all who have studied the country and its interests do, and from him the province may look for larger, broader, more statesman-like measures. The labor difficulty forms one of a cluster lying at the root of the prosperity of the province. These happily solved there is no limit to the advancement of this portion of her Imperial Majesty's Empire. What are needed are energy, resolution, common sense and liberal outlay together with experience. In Mr. Aitchison we have one who admirably satisfies all personal requirements, and in the matter of outlay he has the will if he has not the power. It rests to a great extent with the Supreme Government whether the province shall have capital and labor. The present Chief Commissioner may be trusted to do all he can; but in consequence of financial arrangements, he is unable to spend public money as he pleases beyond a certain limit. Imperial sanction is necessary for all considerable outlays, and to secure matters of imperial importance outlay must needs be of an imperial kind. All that the ripe experience and wisdom of nigh a quarter century of official life, in one of the most trying and responsible positions under Government, may be expected to achieve, Mr. Aitchison may be confidently trusted to perform. But he can no more open out the country without funds than the children of Israel were able to manufacture bricks without straw. In aiming to place the land policy on a popular yet safe basing, the Chief Commissioner is in the right way of removing half the difficulties in the matter of labor and capital. All that is needed under the present *régime* is sufficient funds, and with these there is no reason why the province should not before long take rank as chief amongst the Indian pro-consulates.—*Weekly Review.*

DR. AITKEN ON THE CHEMISTRY OF AGRICULTURE.

WE reproduce the following from the *North British Agriculturist*:—

A resumé of second of these series of lectures on "The Chemistry of Agriculture" was delivered by Dr. Aitken in the hall of the Highland and Agricultural Society:—Dr. Aitken referred to what had been explained in the previous lecture—that plants were living organisms requiring food, that they were able to derive that food from two sources—the air, which contained carbonic acid, water, and ammonia, or the products of its oxidation; and the soil, which also contained these, and which specially contained the mineral constituents of plant food. Plants, like animals, breathed oxygen and gave out carbonic acid, but those which had green leaves were able to decompose carbonic acid in their chlorophyll cells, forming therein the well known substance starch; and eliminating oxygen in the process. This was possible only in sunlight. The starch became soluble, and passed from the chlorophyll cells to all parts of the plant, taking part in the formation of wood. The energy required to perform this work was derived from the sun and stored up in the plant, and this stored-up energy was able to be transformed into active work by animals who used the plants as food. He next proceeded to explain the part which nitrogen played in forming the tissues of plants. He showed that though plants were surrounded by an atmosphere consisting mostly of nitrogen, yet they were not able to make any use of it. Only combined nitrogen, either in the form of ammonia or nitric acid or their salts, or nitrogenous organic bodies, was capable of being assimilated by the roots and leaves of plants. The nitrogen taken up by plants was mostly converted somewhere in their organism into a highly complex organic substance called albumen or protein, which abounded in young, tender, and growing parts of plants. This it did in combining with the starch or other carbo-hydrates present in the plant, water and carbonic acid being eliminated in the process. It went on in darkness as well as in light, and was not dependent on the immediate agency of chlorophyll. The air contained traces of ammonia, and the leaves of plants could absorb it. Rain also washed it out of the air and carried it to the earth, where it soon became converted into nitric acid by various processes, the most interesting of these being that recently discovered by Schloesing, *viz.*, the vital activity of minute germs living in the soil. Nitric acid was converted into nitrates, and in that form it was absorbed by the roots of plants. The amount of ammonia taken up by plants from the air was exceedingly small, and that carried to the earth to be absorbed by their roots was limited, averaging probably not more than from five to ten lbs. per acre annually. This was not sufficient to supply the wants of agriculture, which took nitrogen from the soil in the form of crops to the extent of forty or fifty lbs. per acre annually. Long-continued experiments by Lawes and Gilbert showed that continuous cropping without the application of nitrogenous manure produced with most crops a meagre harvest. Hence the necessity for the application of nitrogenous manures in order to secure large crops. The lecturer next discussed the various sources of loss and gain to the atmosphere of combined nitrogen, and at the close of the lecture drew an instructive picture of the correlation of animal and plant life in the earth. The lecture was illustrated with diagrams and experiments, and was listened to by a large and attentive audience.

ALOE-FIBRE FOR PAPER.

MR. CRUICKSHANK, Collector of South Arcot, has brought to the notice of the Madras Government a very interesting experiment in paper-making conducted under the auspices of the Tehsildar of Cuddalore. Samples of the paper have been submitted to Government, and it is stated that the cost of making the 7½ quires was Rs. 2, "but this cannot be accepted as the real cost, because, if more fibre had been given, more paper could have been made with the same labor. The manufacturers say they can make paper from the aloe at the same cost as from hemp, and that the paper made from each could be sold at Rs. 2 per ream. The Tehsildar thinks that a ream of paper made from the aloe might, if the paper is brought into use, be sold for 1 rupee 12 annas." The Tehsildar, C. Vencataramiah, writes:—"The papers manufactured from the aloe fibre are far superior to the papers manufactured from hemp, and they appear to be finer and more durable than any other papers of country manufacture. Ink does not sink through them, and they are not liable to be torn when folded. The following is the description of the several processes adopted for the manufacture of aloe papers. A certain quantity of aloe leaves were collected and made to soak in water for fifteen days. On the 16th day they were beaten on a stone and washed in water when the matter covering fibre is separated. The fibres thus secured were dried in the sun and a quantity equal to six pounds in weight were then cut into small pieces with a bill-hook and thrown into the tread mill for the purpose of being powdered. Three men were employed to tread the mill while one had to sit near the pit into which the fibres were thrown to re-thurst into it the pieces that escaped the operation of the mill. The beating continued for six hours, and then the powder was taken out of the pit and placed in a heap on the pavement, and pouring water over it, two men trampled on it for about one hour. These two persons, putting the powder in a cloth, washed it in a running stream. The powder was brought again to the pavement where mixing in it chunam dissolved in water it was placed on the pavement. It was allowed to remain in the same state for four days, and on the 5th day the heap was spread over the pavement in the sun. An hour or two afterwards it was again beaten in the mill and again washed as on the previous occasion. Chunam water was again mixed with the powder and left in a heap on the pavement for another four days. The same operation was repeated for the third time and left in a heap for four days more. On the 5th day of the operation for the third time the powder ball was washed and dissolved in fresh water in a tub and papers were then manufactured and dried up. Next day the paste was applied on both sides in order to render the paper to bear smoothening. Six pounds of aloe fibres produced about 7½ quires of paper, and I herewith submit the specimens as ordered."

The Board of Revenue think the sample of paper forwarded by the Collector "is far superior to ordinary country made paper, and, if the material were worked up in England with proper appliances, a really good article would probably be produced. The Board would suggest the preparation of half a ton of fibre to be sent to Messrs. Routledge or other paper manufacturers for experiments." The Madras Government, however, do not see the object of preparing fibre and sending it to Messrs. Routledge for experiment in England. "What is wanted is to develop local manufacture. Endeavours should be made to find some one to make the paper in Madras; it might then be tried in the public offices. Possibly, the manufacturer of the specimens forwarded by the Board might be able to make a quantity sufficiently large to admit of its quantity and cost having a fair trial." We think the Government should themselves see that this experiment has a fair trial. As for the Tehsildar who has made this interesting experiment, he is not even thanked for his exertions.

JUTE IN THE UNITED STATES.

THE Americans are making active efforts to grow jute extensively, and its culture, a matter of prime necessity there, promises to become a great element of prosperity and riches. When we consider that in 1870 the United States raised 1,500 millions of bushels of cereals, this necessitated an enormous number of sacks, the value of which, if made of jute, was estimated at 100 millions of dollars, and a far higher sum if made of cotton, flax or hemp of European growth. The country itself is far from producing anything like a sufficient quantity of raw material for bagging. The Americans now import about 78,000 tons annually of hemp, jute, and other fibres, of the value of 2,500,000 dollars. Many of the States, the southern States especially, are now turning their attention to the culture of hemp and jute, and factories are to be established for making it into bagging.

At Charleston a company has been formed with the special object of entering upon this manufacture. They have bought in the upper part of the town large ware-houses, and have converted them into factories, well fitted. In order to commence work, 300 bales of jute were bought by the company in the States of New York and Ohio, and they have distributed seed freely to sixty or seventy planters, so that if the protective duties which press on the import of this fibre are not reduced, as they are expected to be, in a few years, the culture of jute will be an accomplished fact in South Carolina. Under the auspices of the Department of Agriculture at Washington, experiments have been made in South Carolina, Florida, Georgia, Louisiana and Texas; these have shown that the hemp will grow well wherever the climate is warm and humid, and the soil is of a light sandy clay, in fact, wherever there is an alluvial soil.

Much of the land at present devoted to rice is perfectly suited to jute; the resulting benefits would be immense, and the first outlay insignificantly small. To prove the great importance of the culture of this fibrous plant, let us see what has been done in Bengal. In 1828 less than 40,000 lbs. of this Indian hemp was exported; in 1860, 1,000,000lbs. of fibre and cordage was exported, and 300,000,000 lbs. of fabrics. In 1872, the shipments were 700,000,000lbs., of which 300,000,000 went to England. In 1876, the exports from Calcutta were 5,206,570 cwts. of raw jute, 19,258,250 gunny bags, and 8,532 pieces of cloth, the whole valued at £3,294,521. The land under culture with jute in Bengal exceeds 900,000 acres, and more than one million of inhabitants are employed on it. One plantation alone employs 4,500 work-people, and manufactures more than thirty millions of pounds of jute into gunny bags or sacking.

VANILLA.

THE vanilla bean is the produce of an *orchid* creeper which although growing from the root, is a parasite, as it will grow even when cut from the root, for it takes it substance from the tree around which it clings by means of its thousands of fine tendrils. Like all parasites there are trees which are particularly adapted to its support. They are planted about ten feet apart, in rows, at the foot of small trees which are left in clearing the land. They begin to bear the third year, and in favourable years give from 400 dollars to 1,000 dollars per acre. No cultivation is needed but to cut down the grass and weeds, no ploughing or digging being necessary. The bean is often gathered in September and October, but if left till the end of November or December it comes to perfection. It is then gathered carefully and spread out in the sun on mats, if the weather be favourable, but if otherwise it is placed in ovens, which processes change the colour from a pale green to a rich brownish or purple and at the same time develop the oil, which on pressure exudes from the bean. They are then packed in blankets while warm and put into large tin cases to go through a sweating process; again put in the sun and again in the blankets until they attain the proper colour. They are then placed in a dry room upon shelves made of some open material, so that the air can circulate around and under them. This evaporates all the watery part of the bean. When sufficiently dried, they are put into large cases ready to be assorted into sizes and qualities. The person that raises the beans seldom cures them, for that requires a good deal of care and special attention. There are about fifteen different classes, but they are sold by the packers at one round price. The people will work only about one hundred days in the year, which provides them with all they need, and as they will do no more, there is very little increase in the production of anything. When the beans are assorted they are tied up neatly in bunches of fifty beans each, and packed in cases often holding from two to three thousand. These tin cases are lined with tinfoil, and a ticket placed on the lid giving the quality, size, and quantity. Some five or six of these tin cases are put into a neatly made cedar chest, which is sometimes lined with zinc and hermetically sealed so as to prevent moisture from getting to the vanilla in transport, which would ruin it. These cedar cases are then sewed in mats, and covered with a coarse bagging, to avoid the danger of transportation on mules. In this manner all the Mexican vanilla goes to places of sale in Europe and the United States. Formerly France was the great market for Mexican vanilla, but the enterprise of some of the American merchants has diverted the trade to New York, which is now the great depôt of vanilla.—*Edmund Johnson, Tampico.*

SEWAGE CULTIVATION.

THE following letter on the utilization of sewage from Mr. Alex. Aird, of Danzig, to Mr. J. J. Mechi, should be of interest to many of our readers :—

"I was indeed glad to read your last letter to the *Times* knowing so well, from my own experience, that your repeated appeals for the prevention of the present enormous waste of manure must in time be fully recognised and appreciated. Here, with our Danzig Sewage Farm, we are in our seventh year, and with, I am happy to say, in every respects most happy results. As you will remember, the land we own is or was, of the poorest possible kind—pure 'dunen' sand—and our crops this year, chiefly wheat, barley and rye, have exceeded, both in quantity and quality (as attested by the market agents) those grown on the richest land in the province.

"*During* the past year our farm has been visited by individuals and deputations from all parts of Germany, Russia, &c., and in every case our visitors have expressed their opinion that the system and detail arrangements are 'convincing.' I regret to add that not one Englishman has paid us a visit. I fear the reason is the general opinion that Danzig is a very disagreeable town on the Russian frontier, whereas Danzig can only be described as 'Nuremburg-on-the Sea,' surrounded by the most charming hills and wood scenery. That our arrangements here have proved successful, you, as a practical man, will understand from the fact of our having closed a similar contract with the municipal authorities of Breslau (270,000 inhabitants), we undertaking the laying out of the irrigation lands (3,000 acres) and taking the same in lease for a term of 12 years, on terms satisfactory both for the town and ourselves.

"In Berlin the sewage irrigation system has already proved a very grand success, and deservedly so. All vegetables are sold at a much cheaper rate than formerly, and arrangements have been made in the interests of public health to supply the poorer families with pure milk at a nominal rate. I can safely say that all the larger towns in Germany are preparing to carry out the same system, the German Government having wisely determined to prevent in good time the pollution of their rivers. I read all the English publications I can obtain on this subject, and am almost regretting the 'bungling' (I fear this is the only word to use) that takes place. Most of all do I regret, and this I consider really a disgrace to England, that the Metropolitan Board of Works has so entirely 'shifted the question.' A very moderate outlay would have sufficed to prove results which would have long since established the truth you and I already recognise as to the national benefits to be derived from 'utilisation of sewage.'"

SULPHUR FUMIGATION.

MR. HUGHES writes as follows to the *Ceylon Observer* :—In reply to your communication of yesterday, respecting the preparation of a fuse which on being ignited will evolve thick clouds of sulphurous anhydride without flame, I beg to say that so far as I am aware sulphur when used in fumigating purposes is generally employed alone. Sulphurous anhydride or sulphurous acid fumes, or gas as it is sometimes called, is one of the most powerful reducing agents known, and I apprehended that a mixture of any carbonaceous material would have the effect of very considerably reducing the chemical results of fumigation. Dense volumes of smoke consisting of minute particles of solid carbon with some carbonic oxide and carbonic acid fumes would certainly not increase the chemical action of the sulphur fumes.

There is no doubt that fumigation is the most perfect form of applying sulphur, but the action though uniform and energetic is not so permanent as in the case of the external application of the flowers of sulphur to the leaves, for as soon as the umbrella covering is taken off the rush of air will remove all the existing fumes, which will be carried away by the wind.

Fumigation must assuredly be conducted with much more caution than the comparatively simple process of dusting with sulphur.

It will be necessary to ascertain by practical experiment the quantity of sulphur that may be burned under each tree, so as to destroy the fungus without affecting the fruit, and having had the coverings made of uniform size, it will only be necessary to have the respective fuses of sulphur of a certain definite weight and so remove all possible danger from carelessness on the part of the coolies. The more simple the process the less danger of mistake.

It would be desirable to have the coverings whitewashed with Colombo lime in order to protect the material from the effect of the fumes, which in a short time would soon render them rotten, unless in some way protected from the sulphurous anhydride. It has struck me that whitewashing with lime the stems of the trees as well as the primary branches might as a separate treatment be used in the early stages of leaf disease before the leaves are visibly affected, as appears to be the case from Mr. Morris' very interesting report of experiments at Wallaha published in the *Overland Observer*.

As regards the preparation of a fuse I am of opinion that sulphur will be more effective when used alone, and that a convenient and accurate way of using it would be to obtain sulphur specially rolled in lengths of from 3 to 4 inches and about and ½ inch diameter. These pieces resembling very small cigars could be fastened in slits, let in at the top of sticks which latter could be used again for several subsequent batches of trees.

Perhaps Mr. Brock, the well-known pyrotechnist, could suggest some special fuse which would not detract from the merits of the sulphur fumes. It is quite possible to prepare a fuse that shall give dense volumes of smoke, but I scarcely think that such smoke would be an advantage in fumigating. In conclusion I would strongly recommend great caution in using sulphur by means of fumigation, as otherwise very serious damage may result to the crops.

THE GARDEN.

A WRITER in *Der Deutshe Garten* states that the Imperial Library of China contains 15,000 works on the cultivation of flowers and botany, whereof about 500 are devoted to the rose alone. Such quantities [illegible] roses are grown in the Emperor's gardens that the [illegible] essence prepared therefrom annually brings £5,000 [illegible]ury. Talking of Chinese botanical literature, rem[illegible] Japanese have already adopted the botanical [illegible]ognised in Europe and other countries, and [illegible] of the flora of Japan to which the Latin name[illegible] exceedingly good.

THE Superinte[illegible] of the Government Gardens at Bangalore reports as foll[illegible] the vanilla plants in the Gardens :—The vanilla plant[illegible]imentally cultivated in the Lal Bagh, have not been so h[illegible] after as they were prior to the drought of 1877. The f[illegible]it crop of 1878 fell off, the plants abortively ripened and were in consequence useless. The plants are now showing symptoms of returning health and vigour, there is a good show of blossom at the present time (4th March) and I am not without hope that the vanilla may yet give satisfactory results. Sixteen plants were put down in a "mango tope" last September, and these are growing vigorously now. There are about 200 spare plants in the nursery.

THE net cost of the Botanical Gardens at Mussoorie and Saharunpore is Rs. 25,000 per annum, but the valuable results which they yield, more than compensate for such an apparently large outlay. We are glad to hear, therefore, that a proposal for the reduction of expenditure made some time since by the North-West Provinces Government has since been withdrawn. The Saharunpore garden under the superintendence of Mr. Duthie, whose attainments as a botanist and agriculturist are well known, has been making rapid strides in the direction of improvement. The botanical collection has been considerably increased, and it is hoped that in course of time it will possess one of the finest collections in India. Vegetable seeds and plants and trees are supplied from this garden in large quantities and with satisfactory results. The Mussoorie gardens are worked in conjunction with those at Saharunpore, and are used for the collection of botanical products which will not thrive on the plains. A ready market is found there for all garden products, and as considerable improvements are in contemplation, it is reasonable to suppose that their sphere of usefulness will be much extended.

DRIED VEGETABLES.—We copy the following from the *Journal of Horticulture*, as a matter of general interest to all who may desire to have a supply of fresh vegetables out of season without resorting to the use of those which are preserved by, in many instances, objectionable and unwholesome processes :—'We have recently tested some dried vegetables, which have been submitted to us by Mr. Theodore Alkemade, 3, Melrose Terrace, Stamford-road, Tottenham, who is now on a visit to this country from Nordwyk, Holland. The vegetables have been dried by a process which has been adopted by the Alkemade family for upwards of a century, and they are in great repute on the Continent. During the drying process "nothing," says the proprietor, "has been added to the vegetables, and nothing, except water taken from them ; and when cooked they assume their normal colour, and, to a large extent, their flavour." This we have found true. The vegetables we have tried are scarlet runners cut ready for cooking ; dwarf kidney beans uncut ; and broad beans, small seeds of the Mazagan type. In appearance the dried vegetables are uninviting, being small, hard, and shrivelled, but after being soaked in water for six hours their change is marvellous, their colour returning and their bulk increasing in a very marked manner. When cooked we were surprized by their excellence. While not being equal to freshly gathered vegetables, they approach them far more closely than we expected, and sufficiently so to be acceptable as a change when fresh vegetables of the same kinds are not obtainable. The vegetables, such as the cutting of scarlet runners, have hitherto been prepared by the hand, a necessarily tedious and comparatively expensive process, but machinery is now projected for their preparation, which will no doubt reduce the cost. Although as vegetables out of season, they are not particularly costly now, yet if they can be cheapened they will almost certainly be in large demand for consumption both on land and sea. It may be noted that dwarf kidney beans, popularly termed French beans, are not usually sliced on the Continent ; but varieties such as the *Princess* are grown, and the pods are cooked whole after the beans are formed in them. The dried specimens are of this kind, and on that account are not, we think, likely to be popular in England.'

CARBOLIC ACID IN THE GARDEN.—The very general employment of carbolic acid for sanitary purposes induced a correspondent of the *Vienna Illustrated Gardener*, who relates his experiences in that journal, to try whether it might not be applied with equal advantage in some of the many diseases to which vegetables, as well as flesh, are heirs. He first experimented with a solution of one part of the acid in twenty parts of water, which was allowed to stand for twenty-four hours before being used. By that time a layer of fat or oil had appeared on the surface, the contact of which with plants speedily destroyed them. This was consequently withdrawn by means of a pipette, and the clear fluid below alone used. This proved an equally dangerous application, for some beds of savoys and radishes, which were watered with it in order to free them from ground fleas with which they were infested, were totally destroyed by it. A weaker solution, consisting of one part of acid in fifty of water proved scarcely less injurious to vegetation. The application was now tried in the still more diluted form of one part in a hundred, the supernatant oil being carefully removed before use. In these proportions it answered admirably as an insecticide, without causing the slightest injury to even the tenderest plants. A single application effectually freed the beds from ground lice and similar destructive vermin. A very small quantity introduced into an ant-hill so disturbed its busy inhabitants, that, contrary to all the habits of these insects, they abandoned their pupæ in their hurried flight. A cherry tree whose ripe fruit afforded a favourite hunting-ground for these ants was at once protected from their visits by a slight application of the solution to its stem, though they returned to the attack in four or five days when the pungent smell of the acid was lost. Their further depredations were once for all checked, however, by a girdle of cotton-wool impregnated with the strong acid being bound round the trunk. Many other varieties of insects were kept at bay, or driven from their haunts by the same means, which also formed a most valuable protection against mildew, with which the rose and peach trees in the garden were sadly troubled. In one instance, a rose-tree which had borne no flowers for five previous years in consequence of mildew attacking the young stems of the buds immediately they were formed, was observed to bear a magnificent crop the first season that a timely application of the solution was made.

ROSE GLOIRE DE D JON.

WE have seen this rose grown upon its own roots, but it is generally budded or grafted upon some strong briar as a stock for it. There are several varieties of briars, even amongst those found growing wild in the hedges, woods, and uncultivated places ; some are smooth-skinned, having few thorny hooks upon their stems. Such may prove suitable for some of the weaker and less vigorous-growing roses, but they do not answer well for the Gloire de Dijon ; one cannot give it a too vigorous stock to grow on. In budding, select for it the briars having the roughest skins and the strongest thorns, and then one may reasonably expect to see a healthy plant full of vigour, and yielding a pretty general and continuous succession of flowers during summer, and much later in the autumn than most other kinds. We have seen this rose growing in a greater variety of positions than any other rose that we can remember, and when it has a good stock it is far from being choice about where it may grow. This is a great point in its favour, and, perhaps, one of the reasons why it grows so vigorous and plentiful in the gardens of cottages in almost every conceivable position, yielding a great many flowers during the

season. We are acquainted with a provincial town where many cottagers for miles around it and it may be so with many other towns—grow this rose, which they take to market, and few of the products of their gardens are more remunerative than their Gloire de Dijons.

All roses should not receive the same kind of management, and this rose in different positions requires different treatment. In pruning, don't slash away with the knife upon its fresh and vigorous growth without mercy ; to do so would be to defeat perhaps the *very thing* which you desire to obtain—a regular and moderate continuance of bloom for as long a period of the season as possible. We have seen this rose as a standard amongst others in a row along the sides of walks, and in this position—how differently some people manage it from others !—some persist in cutting it back in the way they generally do most other roses. This may be done at the winter pruning, but to do so during the summer season would prove disastrous. When we have come across this rose as a standard, and have had to do the best we could with it in such a position when it throws out its strong and vigorous shoots, as it is sure to do, let them *grow* to between 3 feet and 4 feet long, and then gently bend these shoots round the head of the bush, or it may be over the head, so as to form a dome. If a well-established plant, there may be shoots enough to bend both ways ; the result of doing this in place of cutting the shoots right away is generally a free breaking out from nearly every eye sooner or later, according to the maturity of shoots. These growths in general soon come into bloom—true, it makes the head look rather bulky, and sometimes causes it to be well supported to prevent wind-waving, but that is of little importance.

We recently saw a villa garden—a very pleasing way of using this round rose—there was a summer-house, the sides and roof of which were completely covered with ivy, with a plant of clematis jackmanii growing up amongst it, but concealed until it reached the top, where it was allowed to develop itself, and show off its beauty in graceful, waving growths, interlaced amongst each other, and full of flowers. There were also some plants of the Gloire de Dijon rose growing up amongst the ivy, in which its long shoots were hid, and the flowers showed well up above the ivy ; then on both sides of the entrance in this summer-house there was raised up to nearly 3 feet high against the wall, and perhaps 4 feet wide, sloping down from the ivy, a sloping bank. This, when we saw it, was in full bloom, as well as the rose and clematis. Here was a band of scarlet pelargoniums ; there the upright walls of dark green ivy ; while on the roof was a garland of flowers on a green ground. These, slightly moved by the breeze, produced quite an interesting picture.—*The Country Gentleman's Magazine.*

THE BOTANICAL GARDENS AT OOTACAMUND.

We make the following extracts from the report on the progress and condition of the Government Botanical Gardens, Ootacamund, for the year 1877-78.—

New plants.—A considerable number of new and valuable plants have been added through exchange and purchase to the garden collection during the past year ; the most important being a collection of upwards of sixty species and varieties, of New Zealand ferns. These were purchased through Captain Campbell Walker from a nurseryman in New Zealand, and with the exception of some tree ferns arrived here in excellent order, and are now established and growing well in the gardens.

A small packet of seed of the true *Cinchona calisaya var. ledgeriana* was received from Major Berkeley ; from this seed 12 plants were raised. These have been increased by cuttings to 57 ; a portion of these have been promised to Major Berkeley ; but I hope to increase the stock largely by cuttings so that a good number of plants of this valuable cinchona may be available for distribution next planting season.

In the spring of last year a gentleman resident in Wynaad sent me a small case of Liberian coffee. As he had no experience in the raising of this coffee from seed, he asked me to germinate them for him in the garden propagating houses. This I agreed to do, and succeeded in raising 410 plants, 350 of which were sent to the owner. Of the remaining 60, 30 were planted in the Burliar Garden, 17 distributed to planters in different parts of the presidency, and the remainder are now in the propagating house in the gardens.

As directed by G. O. No. 3,060, dated 2nd October 1877, four cases containing economic plants, and one case of seeds were forwarded in March last to Messrs. Nicol and Co., Bombay, for transmission to the Livingstonia Mission in Central Africa. The cases contained :—

	Plants.
Cinchona Succirubra and C. Condaminea	228
Tea, Assam Hybrid	138
Coffee Arabica	100
Orange	6
Leechee	7
Nutmeg	2
Cinamon	2
Jalap tubers	6
Ipecacuanha	12

In addition to a large parcel of cinchona and low country seeds sent by Dr. Bidie. The gardens supplied seeds of twelve varieties of Australian eucalypti and acacia, jalap, taraxicum, digitalis, cusco maize, santung cabbage, Brazil cherry and the Hill guava or gooseberry. The plants and seeds were securely packed, and it may be hoped that the greater portion of them will reach Africa in good order.

A case of Nilgiri orchids, indigenous tree and shrub seeds, was sent to A. Lascelles, Esq., Wellington, New Zealand, in exchange for araucarias and New Zealand plants and seeds.

A parcel of cuttings of rheea (*Bœhmeria nivea*) was supplied to the Madras Municipality for trial on their Sewage Farm.

Monsieur Pierre, Director of the Botanic Gardens, Saigon, visited the Ootacamund Gardens in December last, and was supplied with a complete collection of specimens of the different species and varieties of cinchona cultivated on the Nilgiris, also with a number of specimens of the indigenous shola trees.

A case of scions of the finest kinds of apples, pears and plums cultivated in Australia was imported this season for the purpose of grafting stocks in the gardens, but unfortunately they were all dead when they arrived here, having been packed in too green a state. Another attempt will be made to introduce them this season.

The catalogue of timber trees, shrubs, and flowering plants, &c., for sale at the gardens has been carefully revised and 200 copies printed. They can be had gratis on application at the garden office.

The West African coffee plants continue to grow luxuriantly, and are evidently quite at home in the climate of Burliar. The largest plant is now upwards of eight feet high, and is bearing a good crop of plump, healthy berries. Thirteen plants were raised from some seed yielded by this plant last year. From information I have received, I believe Liberian coffee has not been a success in Wynaad, except where it has been planted in warm, sheltered localities. That it will not grow, much less thrive, in the elevated districts in which the Coffee Arabica flourishes, is a point now fully settled. It requires a very much warmer climate than that variety, and in my opinion cannot be grown successfully in Southern India at an elevation over 2,500 feet. Our plants were badly attacked by leaf rust in the autumn of last year, but this disease does not seem to affect the health of this plant to the same extent as it does the common variety.

Some hundreds of young plants of *Pithecolobium saman* or rain tree has been raised from a packet of seed received from the Conservator of Forests.

The mahogany plants put out last year are making a healthy growth, the largest plants now being over 5 feet high.

Cocoa (*Theobroma cocoa*). In consequence of light crops and a succession of bad seasons in the coffee districts of Southern India, it is not suprising that planters and others are now turning their attention to the cultivation of cinchona, cocoa, and other plants that may prove an equally remunerative and less precarious investment. That cocoa will flourish in many of the coffee estates at elevations from 1,000 to 3,000 feet in Wynaad and Coorg I have not the least doubt. It might be planted with advantage between the rows of coffee bushes and in avenues along estate roads. In the spring of last year I distributed gratuitously a number of plants and seeds to planters, who find it thrive and are now anxious to obtain large supplies of plants. Already several thousand seeds have been sent to estate proprietors in Mysore, and I have registered orders for the whole crop of seed that the trees at Burliar will yield this season.

The mangosteen trees blossomed very profusely last year, and are now bearing a heavy crop of fine fruit, a small proportion of which will be reserved for seed.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

The Monthly Meeting of the Society was held on the 27th March, Mr. Justice Jackson presided.

GARDEN

The head Gardener's report was read as follows :—

"I am afraid there is little of interest to report this month. Labour in the various departments goes on steadily, water unfortunately taking up too much of our employés time. It we could by any means secure a connection with the canal outside, we might have a channel running through the Garden, with branches from it, to different parts of the Garden grounds, and then give our plants [which are chiefly cultivated artificially in pots] the benefit of a copious supply of water. We have secured the services of several *malees*, who will prove useful no doubt ; our every endeavour must be concentrated in securing a sufficient staff of *malees* to commence decided and active operations early these rains. Concerning Liberian coffee I must say, that the experiments which have been carried out have been exceedingly barren of results, for out of many batches of cuttings put down only three cuttings formed roots, and those were prepared with the knife in a different manner to the others, which I have tried to make plainer by the diagram sent herewith. I shall repeat this experiment. I have sent one ripe fruit of Coffea Liberica. This is just about the stage of ripeness which warrants their being plucked, they never colour highly, the fruit however will speak for itself. It is now beginning to wither up near the apex. I have also sent several others, these have grown to a certain size, and have then died. I also think the American method of striking cuttings, as mentioned by Mr. Francis of Tirhoot in last month's proceedings, is worth trying on this coffee. Seeds have been received as follows and have been duly sown :—I. Palm seeds from Botanical Garden, Mauritius. II. Moonflower, loquot, sapota, violet from Society. III. Collection of seeds from Andamans, from Mr. E. H. Man.'

"A few leaves of coleus pictus are herewith sent, as perhaps some of the Members may not have seen it thus variegated, it promises to be a very

pretty and also an easily cultivated plant. As the specimen from which these leaves were taken was grown in the shade, the colours are not so brilliant as they would be, provided they received more light, which they certainly would receive if cultivated as out-door plants during the cold season.

A report from the Garden Committee was also read. The Committee express their satisfaction at the state of the Garden and Mr. Gleeson's exertions. They recommend an order on England for a collection of ornamental plants of sorts, principally of roses, and the erection of another large house for the reception of stock plants. Agreed to.

TEA MANURE.

Messrs. Ede and Hobson, agents for Messrs. Ohlendorff's specially prepared tea fertilizer, presents one hundred weight of the manure for trial. *Resolved*, that it be distributed as judiciously as possible for trial in tea gardens, and that it be also tried in the Society's Garden.

APPLICATIONS FOR SEEDS.

Letters were read—From Baron F. Von. Mueller, applying for seed of *Reana luxurians*. As yet in two places only of Queensland have the seeds ripened, though given to many parties. The demand for the seed is very great in such an extensive country as Australia. "I will send you," adds the Baron, "more seeds of *Festuca dives*, as soon as they are ripe again; also I will try to obtain for you the seeds of *araucaria cooku*, but in the present state of trouble in New Caledonia, it may not be possible to get them readily. I am glad that the Indian Government, through the action of Sir Andrew Clarke intends to republish my "select plants." A copy with extensive additional notes will go to Calcutta by this post. The work ought to be of very great use to the whole of Upper India and ought to serve also particularly the Indian Forest Department." From C E. Feudall, Esq., Forest Department, Phillour, applying for seed of *Reana luxurians* for introduction into the Bussahir Sutlej Valley. From Col. W H. Lowther, alluding to the heavy yield of seed of *Reana*. "Fancy reana seeding so heavily in the Nepal Terai that two ounces gave fourteen pounds. Besides this there were two or three cuttings of forage. But then the irrigation resources of my friend Mr. Peppe's lands are unlimited, he has miles of water cuts." From the Deputy Commissioner, Damoh, applying for a quantity of jute seed for distribution in his district, and information as to the mode of culture and preparation. Complied with. From J. Cameron, Esq., Agra, on the subject of rhea specimens for report, and, if not approved of, test specimen to assist him in the preparation of a machine for competition for Government prize. Complied with fully.

HORTICULTURE AT KOTEGHUR.

Read the following extract of letter from Captain Pogson :—"Some years ago, you sent me a few seeds of 'New Zealand Bean,' and of my first crop I gave some to Rev. Mr. Rebsch. This bean has now become completely acclimatised here, and its seeds are called, 'Sparrows Eggs' by the Paharrees.

"In 1871, whilst at Kussowlee, you sent me two or three seeds of a magnificent pumpkin, or gourd from California, and I grew two plants, but the fruit was cut before it could ripen seed. If possible, in due time, I should very much wish to obtain a dozen or more of these seeds, and I will take care to keep all produce, but two, for seed, and let the Society have half of it for distribution to Members. "I am now located in a place having a good soil, lots of water, and a shell lime deposit, a few miles (3½ to 4) distant, consequently I can grow any thing, good land being available. I hope (D. V.) to pass five years out here, and I shall at all times be happy to grow anything, suited to the climate, which you may wish to have raised under an Indian hill sun, previous to introduction into the plains of India. I am told that a very good description of wild pea grows all about the locality, and also a large wild strawberry, the fruit being of the best description. Of course I shall put both under high cultivation and report results, sending you samples. The pea is collected, and eaten boiled, and stewed, just like the cultivated pea. It will be curious if this wild pea turns out to be the father of the cultivated kind. These remarks are equally applicable to the strawberry, with its high fragrance and large sweet fruit."

FORESTRY.

AMONGST our selections will be found a valuable memorandum by the Inspector-General of Forests on the growth of teak. The paper deals with the annual rings, girth and height at different ages, cubic contents of individual trees and the number of trees and cubic contents of growing stock per acre. Statistics have been collected from all the teak-growing districts in India. The Inspector-General invites contributions from all who have any knowledge of the growth and general characteristics of teak.

SLAUGHTERING THE PINE.—The *Oscoda News* publishes the following estimate of the cut of logs which will be attempted the present winter upon the Au Sable and Pine rivers, tributary to that place:—Estimated cut on Au Sable River, 423,250,000; estimated cut on Pine river, 32,500,000; making a grand total of 154,750,000 feet for 1878-9. During the winter of 1872-3 the cut put into the river was between 120 and 130 millions, long timber and all, and during no winter, before or since, has any thing like a similar quantity been put in. Last year the log product was 65,000,000 feet.—*Mississippi Lumberman*.

BRITISH FORESTRY.

THE necessity for the immediate institution of the British School of Forestry has been so clearly proved to be a matter of pressing importance, that it is perfectly evident to all thoughtful people that the matter cannot be delayed much longer with impunity to the national interests. Every State in Europe is far ahead of this country in everything that pertains to the *science* and *theory* of forestry, although we undoubtedly possess, man for man, the best *practical* forestry to be found in Europe or any other part of the world. If the march of improvement had been arrested fifty years ago, and things were always to remain as they then were, we might have been content to rest, in perfect ease and security, on our acknowledged superiority in *practical* forestry. In these days of scientific learning, however, mere practice without a thorough knowledge of the science of forestry is of a little real use beyond the bounds of the parish in which it is acquired, and will never raise a man above the status of an ordinary labourer, unless he is possessed of natural talents, which in a few instances may overcome all educational defects. For the teaching of the higher branches of scientific forestry in a systematic manner, no practical effort has hitherto been made, and consequently we are still without an institution of any kind, in which our foresters can be educated in the science and practice of all branches of their profession, so as to qualify them for holding the highest positions to which foresters can aspire in the British dominions. The want of the means for acquiring a technical knowledge of their profession, appears to be an insurmountable bar to the employment of our foresters in the higher grades of State forestry. No one can gainsay their claim to the possession of the highest practical skill, but her Majesty's Indian Governments, and other of our Colonial Governments require their foresters to possess a thoroughly scientific as well as a practical knowledge of their profession. With this we thoroughly agree; and, moreover, we would strongly urge the necessity of as thorough a training for our home foresters, who desire to rank above the status of common labourers. The lack of this scientific or technical training, is the only objection that can be reasonably urged against the employment of our home trained foresters in the Indian Forest Department hence the adoption by the Indian Government of the expensive, and in many points unprofitable, system of sending their forest students to study the science of forestry at the French Forest School at Nancy.

That we possess the necessary machinery for the efficient teaching of every science and branch of the art of forestry, in an equal degree to that of any Continental forest school, is an indisputable fact, that has been proved and illustrated over and over again; particularly so by Dr. J. Croumbie Brown. Almost all that is necessary for such a purpose is already in existence in connection with other educational institutions, and only requires to be energetically taken in hand and systematically arranged to produce a "Forest School" vastly superior in its teaching and training ability to anything now in existence on the Continent of Europe. In the Universities of London, Edinburgh, or the Queen's in Ireland, there are to be found all the scientific elements that are necessary for the equipment of such an institution; and that a University, or similar educational institution, is the best place for teaching the science of forestry, is now a generally accepted axiom. The system of a separate Forest School, as adopted at Nancy, in France, Munden, in Prussia, and other places, is now found to be both inconvenient and expensive, and is now being generally abandoned on the Continent in favour of forest departments, or schools, attached to established Universities. In these institutions it is found that many of the branches of instruction required in the course upon forestry, such as mathematics, chemistry, botany, natural history, climatology, engineering, drawing, surveying, &c., are already amply provided for; that better laboratories, museums, libraries, and appliances for technical education, can be maintained and be made more widely useful in the larger institutions, and that the student while following his special course, cannot fail of gaining a broader view of science by contact with what is going on around him, than he could if his horizon was bounded by the precincts of an isolated forest academy. Moreover, the students in other departments and classes of the University would give

some knowledge of forestry from what might come under their notice in that department, and the wider acquaintance thus formed would prove advantageous to all classes. A small number of special professors would be sufficient to equip any existing University for this particular service, and a large saving would be realized besides improved efficiency in the general results.

THE GROWTH OF TEAK.

THE following memorandum on this subject by the Inspector-General of Forests has been published :—

For the Manual of Indian timbers, now under preparation, it was necessary to bring together all information available regarding the rate of growth of teak, and it appears advisable to circulate the results at once with the view of eliciting further data in order to complete the account that will be given in the Manual. The following data were brought together with the assistance of Mr. A. Smythies, Assistant Conservator of Forests, Forest School Circle, North-Western Provinces.

2. A brief account of what was known regarding the rate of growth of teak up to 1873, was given on pages 357-359 of the Forest Flora of North-West and Central India. Since then, further data have been collected; but the chief addition to our information on this subject has been made by the publication of Colonel Beddome's Report of 1878 on the Nilambur teak plantations. The data here brought together in no way give a complete account of the rate and mode of growth of teak, and doubtless much more information is available which has not yet been published. It is a most important subject, which should now be taken up separately in each province where teak is cultivated on a large scale, and its study is earnestly recommended. The following remarks will most conveniently be grouped under the head of annual rings, girth and height at different ages, cubic contents of individual trees, and the number of trees and cubic contents of growing stock per acre. It will be remembered that the rate of growth of every species varies between wide limits according to climate, soil, and numerous other circumstances which affect the development of trees.

3. *Annual rings.*—It is now established beyond doubt that the concentric rings which are so marked in the wood of teak correspond each to one year's growth. The following statement exhibits the rings counted on sections of trees grown in the Nilambur plantations, which were cut in 1877. The sections were taken from the base of the stem, and with a few exceptions, the number of rings agrees with the age of the tree. The average diameter is the mean of three diameters. The statement shews the gradual increase of the heartwood as the tree grows older, and it also exhibits the number of rings on one inch of average radius in the wood of trees of different ages. But it must be borne in mind that these sections do not represent the average of each year's plantation, but were selected from the dominant trees. They therefore exhibit a more rapid rate of growth than average specimens would do :—

Year of plantation.	Number of rings counted.	Average diameter of section (wood only.)	Average diameter of heartwood.	Rings per inch of average radius.
		In inches.	In inches.	
1841	33	20·8	19·3	3·17
1845	31	21·1	18·7	2·95
1846	31	20·	17·7	3·10
1847	30	23·8	21·5	2·52
1848	28	16·7	15·1	3·34
1849	28	18·1	16·2	3·09
1850	27	14·	12·5	3·85
1851	25	15·2	13·4	3·28
1852	32*	15·2	13·5	Omitted.
1853	24	15·1	12	3·17
1854	24	17·3	15·2	2·77
1855	23	12·4	10·5	3·71
1856	21	[illegible]	12·6	2·76
1857	20	12·	10·6	3·27
1858	19	14·	11·3	2·71
1859	18	14·	10·6	2·57
1860	17	12·9	10·4	2·63
1861	16	13·1	10·5	2·44
1862	15	11·7	9·	2·56
1863	14	13·6	10·4	2·06
1864	13	12·5	9·4	2·08
1865	12	9·4	6·9	2·55
1866	11	[illegible]	7·3	2·11
1867	10	11·5	8·3	1·69
1868	9	10·5	7·6	1·71
1869	8	7·4	4·8	2·16
1870	7	7·4	4·5	1·89
1871	7	7·7	4·3	1·81
1872	5	6·5	2·6	1·53
				Average 2·62 rings per inch of average radius

4. The sections ranged in age from 5 to 33 years. Dividing them into three groups, two of 10 years each, and the third of 9 years, we obtain the following as the mean diameter in inches of these three groups :—

* There is evidently a mistake here. The tree which yielded this section must have been an older tree standing in the plantation of 1852.

		Inches.
Mean diameter of trees	5—14 years old	9·72
	15—24 "	13·78
	25—33 "	18·71

A section sent from the Thingannecnoung plantation in Burma, cut from a tree 21 years old, planted in 1856, gave 21 rings on a mean diameter of 16·3", the heartwood of which occupied 14·5". This section shewed 2·57 rings per inch of average radius.

5. From other plantations also, sections of teak trees of known age were sent for the Paris Exhibition, but apparently they were not in all cases cut from the base of the stem; they are, however, instructive as shewing the rate of growth and the number of rings on one inch of mean radius.

Year of plantation.	Number of rings counted.	Average diameter of section in inches.		Rings per inch of average radius.
		Wood.	Heartwood.	
South Kanara (Parappa plantation.)				
Not known	10	9·	4·9	2·22
"	5	5·5	2·5	1·81
North Kanara (Kalanady valley.)				
Sulageri, 18 years old	18	8·	6·	4·5
	17	8·8	7·5	3·9
	17	9·	7·	3·7
Murdi, 12 years old	8	7·5	Heartwood not distinct.	2·1
	11	6·		3·7
	11	5·7		3·8
Kadra, 10 years old	8	6·5	...	2·5
	8	7·5	5·	2·1
	7	7·	4·	2·
Bengal (Bamanpokri.)				
1868	8	6·5	2·5	2·5
1871	6	6·	1·	2·
1872	4	5·	1·	1·6
Andamans (Port Blair.)				
1873*	6	10·1	6·	1·2

6. It will be noticed that as far as the data go, which are furnished by the sections received. Thingannecnoung and Bamunpokri exhibit an increase of diameter similar to that of Nilambur; while in the samples from North Kanara the annual rings are much narrower and the specimen from Port Blair shewed an extremely rapid rate of growth.

7. *Girth and height at different ages.*—The following measurement illustrate the rate of growth of teak in plantations in different provinces as nearly as possible from 5 to 5 years. The Nilambur plantation again furnishes the largest amount of information :—

Age.	Mean girth at breast high.	Total height of tree.
Nilambur plantation.—Alluvial soil.		
3—7 years	12 inches	29 feet.
8—12 "	17 "	68 "
13—17 "	23 "	68 "
18—22 "	25 "	71 "
23—27 "	27 "	77 "
29 "	34 "	87 "
30 "	35 "	85 "
31 "	32 "	75 "
32 "	34 "	92 "
33 "	37 "	95 "
Nilambur plantation.—Gneiss and laterite.		
7 years	13 inches.	30 feet.
16 "	14 "	50 "
20 "	21 "	50 "
24—26 "	22 "	52 "
30 "	24 "	50 "

These figures are taken from that portion of Colonel Beddome's report (paragraphs 11—44) which contains his notes on each year's plantation, and the data recorded are stated to be average figures.

8. In another part of his report (paragraph 81), however, he gives data which would seem to shew that the average size of the trees in the older plantations (all on alluvial soil) is considerably greater. He there states the dimensions of the largest, smallest and medium sized trees in four plantations, the results being as follows :—

Age.	Mean girth (probably breast high.)			Length of bole.		
	Largest.	Medium.	Smallest.	Largest.	Medium.	Smallest.
	Inches.	Inches.	Inches.	Feet.	Feet.	Feet.
30 years	67	47	29	79	65	50
31 "	69	49	30	80	65	50
32 "	63	46	30	83	67	50
33 "	68	56	43	86	68	59

The first three lines shew the average of 6 trees in each case, and the last line the average of 8 trees each. It is distinctly stated that the length is that of the bole, and not of the entire tree.

* The tree was probably older.

The plantations made on gneiss and laterite shew a much slower rate of growth than those on alluvial soil; the difference being considerable in height, and much less in girth.

9. Up to 10 years of age, the growth in length of teak on alluvial soil at Nilambur is at the rate of about 6 feet a year, and latter on it is at the rate of only about 1 foot a year. On page 358 of the Forest Flora of North-West and Central India, it is stated "that it is probable that, as a rule, teaks attains half its length with a girth of 2—3 feet." This assumption is borne out by the present figures. The trees grown upon alluvial soil in girth between 25 and 31 inches are from 77 to 87 feet high; and from all that is known regarding the growth of teak in similar localities, it is probable that, unless damaged by storms, disease, insects, or other causes, they will attain a height of 150 feet in soil of this description, and in the climate of Nilambur.

10. From Burma we have the following data. The figures from Pegu represent averages of plantation in the Rangoon, Toungoo and Tharawaddee districts, brought together on page 358 of the Forest Flora of North-West and Central India.

	Age in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Pegu	4	5—9	15—27
	10	15	40—45
	15	23	......
Thinganneenoung ...	21	27	50—60
Garden—Moulmein ...	22	40	......

The fourth line is the average of 150 trees in the Thinganneenoung plantation in the Attaran district of Tenasserim, given in paragraph 146 of the report for 1876-77 of the Tenasserim forests. Major Seaton gives the average height at 30—40 feet, but this probably means the height to the first branch. The maximum girth was 55½ inches. The average rate of growth of the present plantations in Burma is somewhat less rapid than that of the alluvial portion of Nilambur. The last line gives the average of 15 trees measured in 1856 in a private garden at Moulmein. An instance of extremely rapid growth was the tree already mentioned, a section of which was sent from Port Blair for the Paris Exhibition, probably 6 years' old (said to have been planted in 1873, but 6 rings were counted), with a girth of 36 inches and a height of 44 feet.

11. For the Lakvalli plantation in Mysore, the following data are given in Captain Van Someren's report for 1875-76. Age 13—15 years mean girth 14 inches, height 32 feet. This is a remarkably slow rate of growth, considering that the soil is good, and the climate moist, though of course not so forcing as the climate of Nilambur.

12. The plantations in the Central Provinces and Berar have given the following:—

Plantation.	Age in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Machna, Central Provinces ..	6	7	15—22
Pili, Berar	6	4	10
Sakata, Central Provinces ...	7	11	20—25
Pili, Berar	8	8	20
Sonawani, Central Provinces	9	12	30—40
Machna, Central Provinces ...	8—10	9	17—30

Compared with Malabar and Burma, the rate of growth is slow, as may be expected in a dry climate and near the northern limit of the tree.

13. Outside the range of the natural growth of teak, the following data, regarding its rate of growth, are available —

Plantation.	Age, in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Bamunpokri (Sikkim.)	5	5·5	12—15
Kulsi (Assam)	5	11	29
Markúm "	4	9	18
" "	5	11	27
" "	7	16	31

The growth at that early age is fairly good; but it does not follow from these figures that teak in Assam and Sikkim will attain a great age, and produce good timber.

14. The following instances of older trees of known age in Assam and Bengal are on record:—

Locality.	Number of trees measured.	Age, in years.	Mean girth, in inches.
Gauhati, banks of the Brahmaputra...	15	87	85
Royal Botanical Gardens, Calcutta ...	19	6	16
Ditto ditto ...	8	70	79
Garden at Mohesh, Serampore ...	27	50	52

The trees at Gauhti were an average 80—50 feet high.

Trees in the Botanical Garden, Calcutta, were measured in January 1856. The older trees have since been blown down by the cyclones of 1864 and 1867.

On the banks of the Hooghly at Mohesh, below Serampore, stands a grove of teak trees planted in 1828. Their mean girth, breast high, taken by measuring 27 average-sized trees, was 52 inches. The trees were measured in January 1878, and were therefore 50 years old. They are from 40—50 feet high.

15. In paragraphs 177 and 288 of Dr. Schlich's report for 1872-73, the dimensions of a large number of teak trees at different stations of Lower Bengal are given; but unfortunately no trustworthy information regarding their age is available.

16. *Cubic contents of trees at different ages.*—In paragraph 4 of Colonel Beddome's report a statement is given exhibiting the dimensions of the trees sections of which were sent to the Paris Exhibition. As already stated, these trees were selected as samples of the dominant trees, *viz.*, of the those which will eventually be selected to remain on the ground as the ultimate crop, but, with few exceptions, they were not selected from among the largest individuals which had much outrun their neighbours. Arranging them in groups from 10 to 10 years, the following results are obtained:—

Age.	Height of tree, in feet.	Girth at base, in inches.	Length of bole, in feet.	Mean cubic contents, in cubic feet.
4—13 years	48—75	21—60	32—56	10·6
14—23 "	65—110	51—69	40—70	23·8
21—33 "	70—110	60—105	41—72	51·3

This gives us the cubic contents at different ages as follows:—

Mean age.	Cubic contents, in cubic feet.	Periodical annual increment, in cubic feet.
9	10·6	1·1 to 9 years.
19½	23·8	1·3 from 9 to 19 years.
29	51·3	2·8 from 19 to 29 years.

The annual increment increases steadily to the age of 30 years, and probably continues increasing for a considerable time beyond it.

17. *Number of trees and cubic contents of growing stock per acre.*—Regarding the number of trees and the growing stock per acre at different ages, we depend almost entirely upon Nilambur for our data. Sample areas of half an acre each were selected in each of seven plantations; each tree was measured, the cubic contents determined, and the following is the result. It is not expressly stated, but it is probable, that these sample areas were all selected on alluvial soil:—*

Name and year of plantation.	Age of plantation in years.	Number of trees, per acre.	Average length of bole, in feet.	Mean quarter girth of trees, in inches.	Cubical contents in cubic feet. Per tree.	Per acre.	Average annual increment, in cubic feet. Per tree.	Per acre.
Travelly Kava 1841	44	120	59	9·7	41	4,879	1·2	148
Elanjerry .. 1845	32	158	61	7·9	30	4,742	·9	148
Elanjery .. 1846	31	156	69	7·4	27	4,204	·9	136
Moolathamanoo 1847	30	140	62	7·5	27	3,713	·9	124
Moolathamanoo 1848	29	156	60	6·8	21	3,243	·7	112
Elanjerry .. 1858	19	270	45	5·0	8	2,208	·4	116
Wallashary .. 1868	9	750	40	3·4	3	2,491	·4	277

18. Colonel Beddome estimates that on alluvial soil, the teak at Nilambur will reach maturity at from 60 to 80 years; that fellings will be spread in each plantation over 50 years: and that the time of cutting (say at 85 years of age) the mean quarter girth will be 2 feet, the length of bole will be 70 feet, and the mean cubic contents of each tree 280 cubic feet. He also estimates that at that age, there will only be 60 trees to the acre, making the contents per acre 16·800 cubic feet.

No safe speculations can be formed regarding the future of a pure teak forest like that of Nilambur. In its natural state, teak does not grow alone, but is associated with bamboos and a variety of other trees; and it is impossible to foresee the risk of damage by storms, insects, disease, or other causes to which pure teak forests may be exposed. It may be doubted whether, even on the best alluvial soil, the average mean girth of trees 85 years of age will be as much as 8 feet. On the other hand, it is not impossible that the bole will be longer than 70 feet, and it is

* The length of stem to the top of sale measurement, were the head begins, of every tree in the plantations of 1841 to 1848, both inclusive, was measured by sending up a climber with a tape. In the plantations of 1858 and 1868 a large number of felled saplings were available, of which the average was taken.

The mean quarter girth was determined in the following manner. Ten saplings were measured breast high, and in the middle of the stem at half its length, and this gave 5/6 as the reducing factor. Those trees 30 inches in girth breast high were found to have a girth of 25 inches in the middle of the bole.

probable that it will be advantageous to allow more than 60 trees per acre. On page 155 of the Attaran Report of 1880, a plot in the Taintway forests (Yoonsaleen) is described, measuring 3,833 square feet, and stocked with 8 teak trees with clear stems to the first branch of 50 feet, the girth between 4 ft. 6 in and 6 ft. 5in.; this would give 91 trees to the acre. Full stocked forests of oak and beech in Europe 130—180 years old under favourable conditions contain 125—140 trees per acre, with a cubic contents (including tops and branches) of about 11,600 cubic feet. A forest of silver fir in the Jura, 160 years old, was found to contain 94 trees per acre, with a cubic content of 16,000 feet.

19. The total area now stocked at Nilambur is 3,436 acres, of which 1,787 are stocked with a full crop on alluvial soil, the rest not being expected to yield a full crop. In his estimate of the future value of the plantations, Colonel Beddome, only assumes 6,000 cubic feet as the full crop expected on alluvial soil.

In natural forests, where teak is associated with bamboos and other trees, the number of first and second class teak trees (above 4ft. 6in. in girth) rarely attains 10 trees per acre over large areas. The following are instances of forests exceptionally well-stocked with teak:—

Date of survey.	Forest.	Area.	Number per Acre. Class.		Total.
			Girth above 6 feet.	Girth 4½ to 6 feet.	
1870 ..	Bigram (Central Provinces) ..	50 acres ..	4	4·3	8 3
1870-71 ..	Pegu (Prome District)	17 square miles	8 6	3 0	6·6

MINERALOGY.

EVERY seam of coal indicates a fresh movement of the ground; and when it is remembered that, in the South Wales coal-field, as many as eighty distinct beds of coal may be recognized, it will be seen that the coal measures offer striking evidence of oscillations of the level of the land. Between each elevation and depression there must have been time enough for the formation of a thick vegetable soil, and in some cases this must have taken vast periods of time; thus, in South Staffordshire, there is or rather was, a famous bed of coal measuring as much as thirty feet in thickness. Remembering then the slow growth of a forest, the great thickness of some of our coal seams, and the number of separate beds in the coal measures, it will be readily conceded that these strata represent a lapse of time which is probably to be counted by hundreds of thousands of years.—*Huxley's Physiography.*—"Glasgow Herald."

THE WYNAAD GOLD FIELDS.—Mr. Brough Smith has submitted his report for the month of February. He says:—"A considerable portion of my time was occupied during the month in preparing a special report on the Alpha Mine and Works. As soon as that report was completed and forwarded to the Government, I resumed operations in the field and the survey of the following estates has been as far as practicable completed—Richmond, Elizabeth, Downham, Provident, Trevelyan, Dugley Dell, and Needle Rock. I have also examined and delineated on the maps reefs and native workings on the estates known as Sandhurst and Glenrock. Near the summit of Chic-Hudiahbetta, north of the Glenrock bungalow, there are many deep pits—for some few feet perpendicular and continued thence downwards on the underlie of the reef. These workings are traceable by deep excavations and adits quite to the base of the hill, where in a swampy spot heavy gold is said to have been found. There is a large outcrop of quartz in the midst of native workings, in the Sandhurst estate. Gold has been found in a vein not far distant from the Devalah Bazaar, and near the summit of a hill on the Elizabeth Estate; from 'leaders' which the natives have followed by making an adit about thirty feet in length, several pieces of quartz showing gold have been got under my supervision. The native workings on the north-western face of the hill are to be seen over a very large area. Indeed, the workings are nearly continuous from Richmond to Glenrock, and in another direction, from Richmond through Rosedale (where I saw a large reef with native workings), St. Thome Caroline, Adeline, and Yellamun to Yellambullay (Parcherry Hill). I have not yet been able to complete the experiments on the specimens of quartz referred to in previous reports. The planters continue to forward parcels of stone for examination, but my duties in the field have prevented me from undertaking the testing of them." The report has been forwarded to the Government of India.

WE learn from London under date the 7th March, that Mr. Oliver Pegler, Associate of the Royal School of Mines, who visited the Wynaad in 1877 and reported on the importance of the Wynaad Gold Fields to Messrs. W. Nicol and Co., and upon whose reports certain concessions were taken up, had recently penetrated into the interior of French Guiana, and found that rich gold formations existed through the country, equalling the Australian gold fields. He found bold reefs intersecting the country and rich alluvials occuring, many of the river beds giving rich yields; one small pan of dirt gave him fifteen francs worth of gold, and he has brought home many large nuggets of very pure native gold, pronounced in England to be quite equal both in largeness and purity to the earliest Australian fields. Our informant adds that Mr. Pegler states that in Guiana the soil is undisturbed and cannot, therefore, be said to be superior to Wynaad, and he thinks the reef veins in Wynaad are richer than the alluvial beds of French Guiana. We trust the Government will lose no time in publishing Mr. Brough Smyth's report on the Alpha, as we believe it deals on the past and present experience of gold in Wynaad, and, if favourable, ought to be the means of settling one of the most important questions of the day upon which the future welfare of Southern India may be said to depend, and it will be strange if, after the expressed opinions of three such eminent men as King, Pegler and Brough Smyth, the latter a gentleman of the highest reputation in his profession, some definite action is not quickly decided upon. We have more than once urged the creation of a Mining Department for Southern India, so as to regulate and fairly establish an industry which must prove beneficial to India and her people. We therefore, urge upon the local Government the desirability of losing no time in discussing the matter, if possible, before they proceed to the Hills.

The Planters' Gazette.

TEA.

THE cultivation of the tea plant in Kumaon has been fairly successful. The present out-turn is about 300,000 pounds. The Kumaon gardens used to supply large quantities of green tea to the Central Asian markets, but recently, owing to the restrictions introduced in Central Asian commercial matters by Russia, and other obstacles which have arisen, the trade has fallen off considerably. Under these circumstances, it is desirable to ascertain what other agricultural ~~pursuits the valley affords~~ scope for. It is believed that tobacco may be successfully cultivated, and also that Kumaon might supply the Indian markets with a considerable proportion of the dried fruits which are at present imported from Affghanistan. Fruit of all kinds grows there readily, and it is believed that large and well-managed orchards would prove very paying concerns.

INDIVIDUAL efforts to introduce the use of pure Indian teas in England are valuable, and should be encouraged in every possible way; but nothing short of some such comprehensive plan as that proposed by the Indian Tea Sale Co., will, we fear, sufficiently meet the want. It appears that at present there are not more than half a dozen shops in London, one or two in Glasgow, and possibly a few elsewhere, that devote themselves to the sale of pure Indian teas; and it is not difficult to understand the reason. The public taste is yet insufficiently educated; and it requires the capital of an Association; without the intervention of middlemen to sustain for a sufficiently long time retail establishments all over the kingdom for the introduction of pure Indian teas. Such an undertaking could hardly expect, at the outset, to be pecuniarily successful; but in a reasonable time profit would no doubt follow.

THE ninth half-yearly Report of the Teendarea Co. shows a profit on the season's operations of Rs. 9,464-3-10, or 7 per cent. on the capital. The outturn was 72,400 lbs., of which 63,930 lbs. sold in Calcutta at an average price of 0-10-1, and 8,470lbs. sold in London at an equivalent of 0 12-6, or a general average of 0-10-5 per lb. nett. The Report is also in other respects favourable. The Singell Co.'s half-yearly Report to December 1878, quotes a profit on the season's operations of Rs. 42,295-4-2. The total outturn was 2,58,930 lbs.; of which 26,250lbs. were sold in London at an equivalent of 0-11-11 per lb., and 232,680 at 0-9-10 per lb. It will be seen that in the case of the teas of this Co. and

the one before mentioned, the prices realised in London were palpably in advance of the rates fetched in the local market. The difficulty as regards labour is referred to pointedly in the Report. The accounts from the gardens are good, and prospects promising. The Holta Co. has not been so fortunate, and a new manager, Mr. H. Compton, has been appointed. The outturn for the season is estimated at 90,000 lbs.

The Annual Report of the Kangra Valley Tea Co. quotes a profit on the season's operations of Rs. 14,689-5-0, or over 6 per cent. on the capital." This cannot but be considered satisfactory. The average price realized for the portion of the crop of 46,240 lbs. sold was 0-13-0, and it is expected that 0-14-0 will be reached for the balance shipped to London. Mr. McDougall, a trained gardener from Edinburgh, has been brought out as manager. The estimated outturn for the forthcoming season is 56,000 lbs.

THE *Produce Market's Review* speaks of "the great increase in the consumption of Indian teas;" and yet prices continue low, and it may safely be predicated of these low prices that they will continue low so long as the tea is not made with a view to its being sold on its own merits. When it is so made, and honestly put before the public as pure and unmixed Indian tea, the prices will speedily gravitate upwards, as surely as water finds its level.

THE tea bug when it alights on the leaf, is of the ordinary grayish colour; but as it feeds, it assumes a dark greenish tint, corresponding to the sap which it has extracted, and furthermore, if it lodges on your hand or face it inflicts the same smarting and irritable sting as the ordinary mosquito. The history of the insect is of course a very interesting and essential feature in forming plans for its extinction, and we shall be thankful for any further opinions from our esteemed correspondents. We know how varied are the opinions of those who have suffered losses from this insect pest; and we should be rewarded if we could suggest any action that might mitigate the evil. That it has been most destructive there can be no doubt, and worse still it is still a growing evil, for which at present, we know of no remedy; and whoever could put planters in the way of resisting the ravages of this pest would render valuable service, especially to the tea interests of Cachar.

THE following is an estimate of the annual tea production of the world:—

China	...	...	600,000,000 lbs.
India	...	...	35,000,000 ,,
Japan	...	...	40,000,000 ,,
Java	...	...	6,000,000 ,,
			681,000,000 lbs.

IN a review of the Japan tea season 1878-9, the *Japan Herald* comments favourably upon the general results obtained. Prices opened in May well. In June and July the quality fell off. By the close of July, the export for the season amounted in round figures to 7,200,000lbs. against corresponding period 1877-8, 5,720,000lbs. The review goes on to say:

About this period the long expected black teas began to make their appearance, and their novelty attracted some of our sanguine spirits to invest, both for the London and American markets. The teas mostly offered were of inferior make and very deficient in cup quality, being poor and vapid, and sadly lacking character.

Some of the better teas were fairly handsome in leaf, being small and twisted, and some samples showed a fair amount of Pekoe tips, but the bulk of even the good grades shewed a want of finish, the leaf being imperfectly curled, and inclined to be of broken, choppy character. The water, too, of most samples, though fresh and flavory, failed to suit the tastes of the English consumers, but in this respect a more favorable verdict was received from the States.

Many of the chops of black teas came down in common native packages, and in consequence suffered no little deterioration during the time occupied in transit and detention in godowns, before the holders would submit samples for foreign buyers' inspection.

The exports during the past season were as follows:—

Export from 1st May, 1878, to 28th January.

To New York	...	...	17,771,927 lbs.
,, Chicago and Western Cities	...	...	2,863,487 ,,
,, Pacific Coast and Salt Lake, &c.	...	...	2,822,502 ,,
,, Canada	...	...	405,857 ,,
Total		...	23,683,773 lbs.

Here no mention is made of England: probably because the despatch was too limited to deserve notice, although certain parcels which reached the home market were favourably reported on, and realized fair prices. The "Heathen Chinee" is evidently, however in advance of us in India, in avoiding as far as possible, an overstocked market.

STRENUOUS efforts are again being made to raise and produce tea in America. It is found that the tea plant grows well in the States of North and South Carolina, Georgia, and other parts of similar climate. Last winter the Department of Agriculture distributed among the southern States some hundreds of thousands of tea plants, and it is confidently believed that within a few years American tea can be successfully placed upon the markets of the world, and, as it is put, "demonstrate the practicability of providing our peoples with a better article of tea than they are now able to obtain, and the possibility of saving to our country from nineteen to twenty millions of dollars in coin, which annually finds its way into the coffers of British merchants, who have substantially a monopoly of Chinese trade." A planter of Georgetown, South Carolina, has already sent up to Baltimore to be manufactured over 1,000 ounces of leaf grown on his property, which is said to have an aroma equally agreeable to the tea of Japan, or that of Moyenne in China. The latitudes in which tea is successfully cultivated in China, Assam, and Japan, correspond geographically with the latitudes embraced in the States of Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Alabama, Tennessee, Kentucky, Arkansas, Missouri, and portion of the Pacific coast, and the conditions of temperature, soil, &c., are about the same. Wilmington, in Delaware, is parallel with Peking, one of the finest tea-growing districts in China, and the upper portions of South Carolina are parallel with three of the most abundant of the tea-producing provinces. So with the other States mentioned. As a home industry, furnishing highly pleasant and profitable employment to the wives and children of certain sections of the country, it may at no distant day become an industry of great value. The possibility that the tea leaf may be cured and prepared by modern means and appliances rather than by the tedious hand processes at present employed, promises sufficiently well to induce the necessary experiments, for if successful, the expensive part of preparing would be done away with, and as an industry, tea producing be placed in comparative advance, as was cotton by the gin and sugar by the centrifugal pan.

THE CHINA TEA TRADE.

IT is generally supposed that though immense quantity of tea are consumed in Europe, the European tea-drinkers are quite ignorant of the delicate flavour that really good tea ought to possess. The finest teas are drunk only by the Mandarins, and are consequently kept in China; and the next best quality, it is said finds its way to Russia, and is consumed exclusively by the nobles, and being carried overland does not deteriorate on the journey, as tea is said to do by a sea voyage. Be this as it may—that is, whether an ordinary shipload of tea does deteriorate by a usual sea voyage from China to London—it is well known that there is a brisk competition between fast-sailing ships to bring the new season's tea to London in as short a time as possible—in short, an ocean race of clipper ships. To furnish these cargoes unusual hurry must prevail in the gathering and drying of the leaves, so that it is doubtful whether the tea so brought is after all of the superior quality attributed to it. This opinion is to some extent verified by Mr. Consul Sinclair's report on the tea trade of Foochow during the past year. He says:—"At the opening of the market in May there was manifested the same eagerness among buyers for rapid shipment by the quickest route, the same rivalry to be the first to lay

down the new teas in the London market. Evidently this is the chief aim among buyers for home consumption. One would suppose that this hurry to buy and ship off would hardly leave time for the study of the leaf; cargoes must in many instances be put on board in an imperfect state. A competition begun among the tea-men or brokers for the purchase of the teas from the country growers, and followed up by a spirited competition among foreign buyers to obtain the teas from the tea-men, cannot fail to enhance the price of the article for exportation. One other result of this double competition is, the neglect of the growers to improve the cultivation of the tea plant. The shrub is left to wear itself out; the leaf, at first left too long on the trees, in order to obtain larger eaves with greater weight of tea, is then hurriedly picked, and the tea hastily prepared. No better proof of this exists than the marked inferiority of the tea shipped from this port during the last few years.

The growers find the present production sufficient for the wants of the foreign market; it is however noticeable that from Pan-yang, Fuh-ngan, and Ping-nagn, districts near to Foochow, the quantity of tea brought to market during the past three or four years has been steadily increasing and may now be estimated at almost double what it was about six or seven years ago. In the inland districts the cultivation, or rather the production of tea, does not increase to any marked extent. Natives state the quantity of tea brought to market could be largely, almost indefinitely increased, if there existed the demand. Of late years no teas of really prime quality can be obtained in Foochow in any large quantity; the low prices on the London market and the competition with Indian-made teas has probably much to do in bringing about this result."

Unless very much care is bestowed on the picking and preparation of the leaf by the native growers, and more study devoted to the subject generally, it is to be feared that Hankow and Calcutta may eventually become the shipping ports for a safe and marketable article. Both these ports supply the home trade with fine, strong, and well-prepared teas, which are in consequence, readily saleable; they are so much liked by consumers, and are gradually gaining so from a hold in the United Kingdom that the article sent forward from Foochow is beginning to rank only as common to medium tea, and is sometimes difficult to realise.

COFFEE.

LIBERIAN COFFEE.

SINCE it was brought into commerce, this robust growing species has created a good deal of interest here. At first there were no facts upon which a right judgment could be formed, now however, the first imported plants have begun to bear fruit, and its merits or demerits may be discussed with some degree of safety.

The Liberian species forms a real tree, and I am of opinion that the dwarfer growth of the Arabian plant renders the latter a much better plant for cultivation on a large scale. The bean of the new sort is large; the beverage it furnishes is not inferior to that of the common coffee, and the productiveness of the plant seems to be a large one, the young trees having been literally loaded with berries. The most important difference however, must be looked for in the structure of fruit. The fleshy part or mesocarpium of the berry of Coffea Liberica is much more developed than it is in the berry of the common coffee plant and this is a defect which decides the matter. To comprehend this it must be considered that the tedious and toublesome preparation of the crop for the market consists exclusively in the removal of the cover which encloses the bean. The following figures, which I obtained by careful weighing, may show the great difference :—

	Weight of pericarpium and endocarpium (or shell).	Weight of ndospear (or bean.)
Coffea Liberica	4·40 grammes	1·20 grammes.
„ Arabica	1·35 „	0·60 „

The proportion of the wor'hless shell to the bean is nearly as 4 to 1 with Coffea Liberica, while it does not attain 2 to 1 in Coffea Arabica. Besides this, the Liberian fruit requires a full year for its maturity.

Resting upon these facts, I consider the new Liberian species totally unfit to rival the common Coffea Arabica as a plant for cultivation on a large scale.—*A. Lietze, Rio de Janeiro, February* 1879.

MR. JOHN PAYNE, writes as follows to the Agri-Horticultural Society from the Tinnevelly District:—"About a month after I wrote my letter of the 20th November, I was sorry to discover the finest of the two 'Liberian' plants alluded to, was attacked by leaf disease (there is not a coffee tree within miles of it). The disease appeared to have started from below, the upper portion being free. I immediately had it fumigated by having pieces of burning charcoal spread about on the ground below, and to windward, on which was cast powder of sulphur. I was afraid it was overdone, but have since learnt, further than the scorched leaves having dropped off, no damage has been done, that the plant is free of the disease, and the one within eight feet and leeward of it, is still free of any disease, so that at this moment both plants may be said to be flourishing. It will prove a palliative, but nothing more I fear, that is, one may go on fumigating for life; I am one of those that think a certain state of atmosphere has much to do with the ravages of the *Hemileia vastatrix*. I have always observed the disease to appear shortly after the blowing of a nasty cutting wind from a point, not usual at that season of the year, and whilst it lasts the disease appears to spread. The wind I speak of affects man and beast alike, going through one, so to speak, and as sure as it blows, the disease appears; yet it does not affect all parts of an estate (the poorer portion suffer first and most); some portions which to this day are free of disease; others are regularly attacked. This, I account for from the fact of the estate lying in a gully, to right and left of which are smaller gullies at various angles, so that some naturally escape the wind, and I have further noticed a continuous lay of land once attacked, the disease invariably goes through it, sometimes stopping at the ridges. I am glad to say we have less of this plague this year. A neighbouring estate was attacked most severely two years before the disease found its way into this valley, in which it first, and for two years, confined itself to the coffee plants in the forest, before coming out into the open clearings."

Mr. H. R. Dawson of Madras reports:—"In August 1877, I received from the Gardens three plants of Liberian coffee. They were about from 6 to 8 inches in height, and apparently in perfect health. I kept them in the pots in which I received them until November of the same year, when I transplanted them into the largest sized pots ordinarily used in gardens in Madras. They had then made about two pairs of new leaves each. On the 25th of March I left Madras for England, and at the same time left my plants in very good hands (Major C. C. Sargeaunt, who rented my house.) At that time two of the plants had thrown out primaries. In July, while at home, I received a letter from Major Sargeaunt, in which he mentioned that the Liberian coffee plants had suffered very much from the hot weather, and recommended their removal to my coffee estate. I returned to Madras early in November last. I found that two of the plants had made great growth, but were looking anything but healthy. The wood was bark bound, and the foliage, instead of being a dark glossy green, was a pale yellow. The third plant had been 'stumped,' and rightly so, as it was dying downwards; it had thrown up a new shoot, but I do not think that it will ever recover. The few leaves on it are yellow and partially withered. Of the two other plants, one is in a pot and one planted out in the shade; the former has recovered itself wonderfully during the past two months. It has nine pairs of primaries, and is fairly healthy in appearance, that is, it is now green instead of yellow. Its height is 3 feet, bark healthy (which it is shedding, a good feature) and no sign of blossoming, which I also take as a good sign. The plant, which is planted out, is not so vigorous as its pot companion; it has eight pairs of primaries, has somewhat recovered its colour as regards foliage, but what I consider a bad sign is, it has blossomed too early considering its age. Four blossoms expanded on the 26th January and six on the 6th instant. They appeared healthy, the blossoms dropped on the day following the expansion, the berry on the peduncle is swelling, and may with care and attention mature, but I doubt it. It is not natural for the plant to bear so early. The plant is either diseased, or the soil, which is a stiff clay, or the climate, are the causes of such precociousness. I will watch it and report results hereafter." It may be interesting to add that Dr. Cornish has succeeded in growing two healthy looking Liberian plants in a plantain tope in his garden, where they get much cool shade, and that the plants have recently blossomed.

COFFEE PRODUCTION.*

MR. TYTLER points out how that slave labor being forced is fatal to its possessors. In Brazil, it is slave labour; in Java forced labour. The great drawback, as he truly points out, is that with such countries as Brazil, the cost of maintaining labour out of crop time makes it too costly, whereas we in Ceylon obtain our labour when we require it and can pay off coolies not wanted after the crop is in, and who are only too glad to return to their country close at hand, to revisit their friends with their girdles well filled with rupees. "Where, elsewhere," he asks with great force, "do conditions of labour, such as these, suitable for coffee cultivation, exist? And a labour so suitable and so secure? It suits them, and it suits us. So long therefore as the Governments of India and Ceylon do not interfere injuriously (for interference must be injurious) with the influx and efflux of this stream of voluntary labour—so beneficial to the planter, so advantageous to the humble poor of India—so long as free currency is afforded to the natural adjustment of the supply and demand, with its own preference of route—we, as coffee planters in Ceylon, or as employers of Indian labour for coffee, tea,

* The Position and Prospects of Coffee Production as affecting the value of Ceylon coffee estates: by R. B. Tytler, of Ceylon.

cinchona, cinnamon or cacoa, or any other branches of industry, may bless ourselves that we possess a source of labour such as no other country of the world possesses for our peculiar demands. Such labour is the pivot upon which the question turns."

"The Brazilian coffee planters having in the first instance drawn off from other pursuits all the slave labour of the empire, are now on the verge of despair, seeing clearly enough what emancipation cannot fail to do for them. Mr. Tytler never believed in freed slave labour, and he saw something of that in his early experience of coffee planting in the West Indies. It is evident from the recent utterances of proprietors at their great agricultural session in the Brazilian capital, that neither do they believe in it. The author of this little work declares emphatically that they are wrecked upon the strand of labour. "Nothing in the end can save them. Endless resource of virgin forest for extension by surplus slave labour out of crop has resulted in boundless expanse of planted land, for the gathering of the crops of which there is not sufficient labour, nor can it be found. Borrowed capital, got on a superficial glossed surface of apparent, and for the time ardent prosperity, spun out a system of railways, and afforded the Brazilian the means of getting to the Barcadere his produce, to exhibit a momentarily manifest prosperity; but it was all on borrowed capital which had a basis of very questionable security, namely, slavery, and the issue of slave labour. Labour collapsing, what comes of the security upon railway debentures? What for that of the borrowed capital? What of all securities connected with the enterprise of Brazil? Let those concerned consider these questions, and, if possible, provide for them. I am merely considering how they affect the question of the supply of coffee to the market of the world, and next how this touches the value of estates in Ceylon."

It is well for Ceylon that our planters have seen and acted upon the wisdom of a thoughtful and paternal care for the comfort and well-being of their coolies. None were so careful on this point as the proprietor of Pallikellai, whose labourers were better housed and better disciplined, than the large majority of those who came to the Ceylon coffee estates. The best proof of this is to be found in the fact, that in the times of the greatest labour scarcity, Mr. Tytler never wanted for hands to cultivate his estates.

THE COFFEE INDUSTRY OF THE WORLD.

TO enable us to form anything approaching a correct estimation of labour supply as likely to affect the future production of coffee, we should not confine our observations to the new countries and those likely to come into the field as coffee producers: the whole, or if that be not possible owing to the absence of data, the larger existing countries in the field should be taken into account, and their prospects as to labor supply examined with a view to future prospects. In attempting to take but a glance at the various countries engaged in coffee production, it will be instructive if we first give the names of such colonies and countries which supplied Great Britain with coffee half a century ago, say in the year 1825, with the quantities taken from each of them. These are as follow:—

		In 1825.
Jamaica	cwts.	169,729
Demerara	,,	54,147
St. Domingo	,,	44,422
East India, Java, &c.	,,	36,735
Cuba	,,	24,057
Berbice	,,	18,558
Dominica...	,,	17,137
Brazils	,,	12 467
St. Thomas	,,	7,250
Port Rico...	,,	4,620
Caraccas	,,	3,602
St. Lucia	,,	3,353
N. America	,,	1,636
St. Lucia	,,	1,400
Trinidad	,,	1,954
Guadaloupe	,,	1,200
Bermuda	,,	792
Barbadoes	,,	236
Grenada	,,	368
St. Vincent	,,	54
Bahamas	,,	120
Coast of Africa	,,	91
Buenos Ayres	,,	64

It is instructive to note the changed position of some of the above coffee producing countries, which from fourth and fifth rate countries, have taken the lead far in advance of such countries as formerly ranked first for our coffee supplies, such for instance as Cuba, Demerara, and Berbice now sunk into insignificance. Coffee recently sold from the latter colony has been spoken of by a contemporary as though it were a new product, whereas half a century ago it was exported to England in larger quantities than coffee from Brazils.

In the list of countries producing the coffee of the present day we shall find that a great revolution has come over the coffee industry of the world, some of the old producers having altogether disappeared from the list. The following statement gives a tolerably accurate idea of the coffee imported into Great Britain forty years later than the former period:—

Ceylon	cwts.	727,038
Madras	,,	108,639
Brazils	,,	88,906
Central America	,,	63,396
British West India Islands	,,	40,312
New Granada	,,	26,623
Hayti and St. Domingo	,,	19,849
United States	,,	8,745
British India, Bombay, &c	,,	8,280
Ports on the Pacific	,,	7,962
Singapore and Eastern Staits settlements ...	,,	8,670
Philippine Island	,,	6,590
Port Rico	,,	4,378
British poss. in South Africa	,,	3,586
Egypt	,,	3,349
Other Ports	,,	3,069
Portugal	,,	1,916
West Africa	,,	1,555
British Honduras	,,	1,487
France	,,	1,268
Hamburg	,,	912
Holland	,,	627
Cuba	,,	279
Bengal and Pegu	,,	61
South Atlantic Ports	,,	20

Whatever figures may be put forward as representing the consumption of the world against the production, this much we know, that allowing for the fluctuations incidental to seasons of abundant crops and times of depression in general trade, such as that we are now passing through, the stocks of coffee throughout Europe have not seriously augmented, notwithstanding extensive plantings in Ceylon, Brazil, India, Java, and Demerara: on the contrary, present stocks are about on the average of the last five years. Reliable information from various countries shews that there is at the present moment a lull in the extension of the coffee industry of the world. Whilst this is the case, we must not forget that the populations who consume our produce are streadily on the increase, and that each year finds so many more thousands born into the world to become in due course, customers to the producers of coffee.

In Ceylon, the exhaustion of our forest land, in Brazil the labour difficulty, and in many countries coffee pests and other impediments stand like lions in the path of progress. It is worthy of note that whilst we in Ceylon have been inundated with labourers of all descriptions, many worthless, it is true, by the recent famine in South India, the terrible year of drought and starvation in the Northern provinces of Brazil does not appear to have added a single, labourer to the coffee plantations of the South, a sure evidence that they have nothing to hope for, nothing to calculate upon in the indigenous labour of the empire. At the very time when tens of thousands of pounds were being voted by the Brazilian Legislature for the famishing inhabitants of the North, the planters of the South were discussing and lamenting, in full assembly, the starvation of their labour supply and the gloomy outlook before them in consequence. Nor has the great coffee country of the South American Continent escaped the ordinary trials which beset the industry elsewhere. There, too, they are suffering from unfavourable seasons and from a pest which promises to become serious in the future, if not so detrimental as leaf disease.

What has been the influence thus far of railway construction and higher cultivation in that extensive country, may be judged from the latest statistics of the Brazil coffee trade, which give the following as the exports for three years ending December 31, 1878:—

		1878.	1877.	1876.
Rio	tons	16,7240	162,105	159,043
Santos	,,	64,762	40,795	38,929
	Tons	23,202	202,900	197,972

How much land may have been brought under coffee cultivation during the last few years of high prices is not known, but it is not likely that this will continue in view of the extreme difficulty of supplying the necessary amount of labor for existing cultivation. Whatever quantity grown, will, with the present and other lines of railway in course of construction, be brought more rapidly to market, but it is improbable that railways will help the labor supply, for the mule drivers and others now engaged in the old fashioned mode of transport, when thrown out of work by railways, will not take to labor on estates.

TOBACCO.

TWO years ago Messrs. Begg, Sutherland and Co. took over the Ghazipore tobacco-farm which had hitherto not been very successful. Under their care, however, very favourable results have been obtained, and it may be fairly hoped that the cultivation will continue to improve and extend. The results would have been still more satisfactory, but for the continuous ill-health of the curer, Mr. Williamson. Some tobacco sent home for sale last year realised three times as much as any Indian tobacco previously exported. An English firm of tobacco manufacturers have offered to take a large supply of the leaf annually at rates which will give a fair profit. A trained cigar manufacturer is shortly to be added to the assistants on the farm, and it is hoped that Messrs. Begg, Sutherland and Co. will soon be able to supply a good brand of cigars. An attempt made last year to grow tobacco at Kumaon did not prove very successful, but another endeavour is to be made this year, and it is hoped the results will be more satisfactory.

INDIAN TOBACCO.

BELIEVING you take considerable interest in the cultivation of the tobacco crop in India I beg to say I have been nearly twenty-five years engaged in growing and manufacturing tobacco in South and North America, and during the past three years I have taken considerable interest in the weed grown in India. During the past month I have been in the tobacco-growing districts of Madura, the Pulney Hills, Trichinopoly, and along the line of the South Indian railroad. In every place I visited I found splendid specimens of the leaf tobacco, which if properly cured would compare most favourably with the very best grown American leaf tobacco, and from which I have no hesitation in saying can be produced or duplicated the most celebrated brands of American cake or plug tobacco, as well as the famous brands of smoking tobacco, *viz.*, "The Lone Jack," the "Fruits and Flowers" of old Virginia, the "Golden Sceptre" &c., all of which cost an enormous price in Madras. This could be done, if the tobacco was properly cured, but it is not. How can we have it cured as it should be? By teaching the cultivators the method used by the planters in America, Spain, and Cuba. You may ask me, "How are we to teach the proper method of curing tobacco to our planters?" I will tell you, Sir, by printing a small book and having it widely distributed through the Madras Presidency, as I believe Mr. Buck has done in the North-West Provinces, advocating the best methods of planting and curing tobacco. Mr. Buck deserves all praise for his efforts to improve the cultivation of tobacco, although he admits he has had no practical knowledge, and has compiled his book from information given him by others. Another advantage will arise from the proper cultivation and curing of tobacco. You can ship tobacco to England, and successfully compete with the American shippers who receive very high prices for their produce. Three years ago I saw 1s. 2*d.* per lb., paid in the Liverpool Market for fair "Virginia" sun-cured tobacco, and I am quite sure you have, or could have, produced in this Presidency quite as good. Again, you have a great advantage over the American planter. He has, in many instances, to cure his tobacco by fire, which injures and gives the leaf a very bitter taste, whilst your planters can at all times sun-cure their tobacco. Your planters do not know it perhaps, but they can raise and cure two crops yearly in this Presidency. I saw the experiment successfully tried in the Coimbatore district last year. On the whole, I believe, the tobacco grown in India is better than that of America, for you can make cigars from nearly all grown here, whilst in America but one or two sorts are capable of producing tobacco fit for cigar-fillers, and the wrapper must be imported from Spain or Cuba. Connecticut, Massachusetts and Delaware produce a small quantity of cigar-tobacco yearly; Maryland, Virginia and North Carolina are justly celebrated, and manufacture nearly all the fine brands of Plug and smoking tobacco exported. The tobacco grown in the Western States of Tennessee, Ohio, Kentucky, and Missouri is very coarse and strong, and can only be used for Navy Plug. Your planters can do all that those States I have mentioned can do. But with all your advantages, you will rarely find as good a cigar here as you can purchase in either England or America; and the reason is, your cigar merchants do not prepare the tobacco to be used for cigars properly, nor do they pay the proper attention they should to the cigars when made. Thus you will often find a cigar that will not smoke, and again if it does smoke, it will often make an unpleasant noise, somewhat like that of a dirty or wet pipe. I will not trouble you further at present on the tobacco question, but should you desire it, I will give you the best methods adopted in America and Cuba—1st for preparing the seed beds, cultivating, manuring &c.; 2nd cultivating and manuring the ground for the plants, as well as the care required to bring the plant to maturity; 3rd, curing of the same; 4th, the proper way the tobacco should be handled and packed for exportation to England, &c.; and lastly, the manner of preparing and curing tobacco for cigar making—and when made, the manner in which cigars should be cured and packed.—*Tanjore Correspondent.*

CINCHONA.

CINCHONA CULTURE.

WE are glad to see that Dr. Biddie has published in the form of a handy little pamphlet of 24 pages duodecimo, his interesting and useful lecture delivered at the Madras museum on this subject. The brochure is entitled "Cinchona culture in British India, being a brief sketch of its origin, with practical hints on the chief points connected with the industry by G. Bidie, M.B. Madras, Higginbotham and Co., 1879." Coming from such a pen, the practical hints, which are the valuable part of the book, are sure to be reliable, for besides other means of being well informed on the subject, it is mentioned in the preface that it was Dr. Bidie's "good fortune, as well as pleasure, to have visited the Government cinchona estates very frequently, and to have enjoyed special facilities for gaining information during those visits." It will be remembered that Dr. Bidie was selected to be one of the late Government commission on important questions in connection with the best manner of utilizing the cinchona bark. Perhaps, the best way of giving our readers an idea of the nature of this very business-like little production, is to present them with a copy of the table of contents, which runs as follows:—"Introduction—Introduction of the cinchonas into India—Government action in cinchona culture—Botanical sketch of the cinchonas—Remarks on the habitats of the cinchonas—Chemistry of cinchona barks—Discovery of quinine—Medical value of the several alkaloids—Local manufacture of a cheap cinchona febrifuge—Proportion of alkaloids on the several barks—*Red Bark—Crown Bark—Yellow Bark*—Other species—Hybrids—Changes in cinchona bark according to the age of the tree—Culture of cinchona—Manuring cinchonas—Harvesting the bark—*Mossing, coppicing, uprooting*—Comparative yield of bark by the several systems of harvesting—Drying the bark—Seasons of the year at which the barks are richest in alkaloids—Cinchona culture likely to continue remunerative?" There are two plates and two diagrams in the pamphlet, the price of which is fixed at one rupee.

SERICULTURE.

SERICULTURE IN INDIA.

IN reference to our incidental remark a fortnight ago on sericulture in Dharwar, as it used to be carried on a few years ago, a correspondent sends us the following:—

"The great advantages of Dharwar, over other places in Western India are:—1st an admirable medium climate all the year round; 2nd, a medium rain fall—so that the atmosphere is never too damp or very hot; 3rd, mulberry shrubs grow admirably and never fail; and 4th, you have the monthly silk-worm which thrives well, throws off cocoons eight or nine months in the year, thus giving steady work to the people engaged. 5th, the silk is easily wound off and even though roughly reeled by the hand, produces such beautiful dresses as you have seen. If these advantages are not sufficient, I do not know where you get any thing like them in India. I think to these above points I might add a caution, viz., that when they find the monthly worm doing well, don't breed it with any other, but be content; this indiscriminate crossing has caused the continual failures in sericulture in Southern India."

SILK OF THE TASAR WORM.

THE following Government resolution on this subject has been issued:— In the Resolution of the 23rd November 1875, the Government of India stated the facts regarding the production of tasar silk so far as they were known to it, as well as the steps taken or under consideration in reference to the utilisation of this article and the development of a regular industry. The general conclusion which seemed to be justified by the information before it was, that the domestication of the tasar worm offered no prospect of remuneration even if the process were in itself possible; but that if certain difficulties arising from natural conditions connected with the collection of the worm in its wild or in a semi-domesticated state could be overcome, and that if the silk could be satisfactorily reeled and dyed,—for difficulties had been encountered in connection with both processes,—a regular and extensive export trade from India to Europe, either in the shape of cocoons or as raw silk, would spring up; for it seemed certain that European manufacturers would take the raw produce if laid down at reasonable prices.

2. The first step to be taken, however, was to procure further information. It was obviously premature to take any measures having in view the creation of a regular industry without first obtaining definite information on important points on which information was wanting either wholly or in part. Such points were; the exact cost at which the raw material could be collected or produced in commercial quantities, both in the wild and semi-domesticated state; the cost of reeling the silk; the weight of silk in proportion to cocoon; the degree in which the filaments would bear *croissure*; and the consequent ultimate value of the silk in the market. As a first step towards the obtainment of such data, the Government of Bombay and the Chief Commissioner of the Central Provinces were requested to collect a quantity of cocoons in order that careful experiments might be made with them in this country, as also under the direction of her Majesty's Secretary of State in some of the leading filatures in France and Italy. This was done, and the results of the experiments undertaken by Mr. Wardle under the direction of the Secretary of State with the cocoons thus supplied are now before the Government of India and are stated in his reports attached to this Resolution. No experiments were made in this country, the gentlemen to whom cocoons were supplied for the purpose having pronounced them to be old and unfit for reeling, especially in this country, where the special machinery and appliances required for this purpose are not available. This is of little consequence, however, considering the success of the experiments in Europe, and having regard to the fact that in all probability filatures in India for tasar silk will not be required, and that only a trade in cocoons will prove remunerative.

3. At the same time that these cocoons were collected in the Central Provinces, the other local Governments and Administrations were invited to make proposals and suggestions in the matter.

4. The result of the enquiries and experiments made in India has not, on the whole, advanced matters very far. In the Bombay Presidency the experiments undertaken by Major Coussmaker for the semi-domestication of the worm were interrupted by the drought and famine. They have since been renewed but as yet with inconclusive results. These are stated in a letter from Major Coussmaker, from which the following paragraphs are extracted:—

* * * * * * * *

"2. My former experiments, as well as those conducted by Mr. Woodrow, had proved that it was a mistake to attempt to rear these worms on twigs either those cut from road-side trees, or from those which had received some care and attention in a garden, and that the plan most likely to succeed was to feed them on shrubs in localities where they could be protected from their enemies, and, if need be, from unfavourable weather. With this view, I began to collect young plants.

"3. I had noticed in 1876 that the tasar worm throve well on *Lagerstræmia indica*, an ornamental shrub, fairly abundant in the cantonment of Poona; this is a plant which throws up a good many suckers during the monsoon, and I soon got a few plants together. I took a house which was well supplied with shade and water, and my gardener managed to collect 172 plants between December and July, many of them only a few inches high, but some were large enough to be of use. There were also in the ground six bushes, and my first care, when I came in from the districts, was to cut them all back to the hard wood, and apply to their roots a fair amount of manure. The consequence was that as soon as the rain commenced the plants shot most freely into leaf.

"4. Mr. Woodrow had not been able to save any seed cocoons, but I had found three female cocoons in the districts, and the Marathi woman, who had been my chief assistant in looking after these worms before, had collected twelve. I soon had several moths from these cocoons, and found, as I had noticed before, that there was [illegible] difficulty in getting an abundant supply of fertile eggs. Hardly any [illegible] were wasted; it was only necessary to put them out over-night, on any bush, and it was almost a certainty to find them paired at daybreak. I found that it was not necessary to tether them; they rarely moved from the twig on which I placed them. As fast as the young worms hatched out, I put the trays containing them among the leaves of the [illegible] and in a few [illegible] they commenced [illegible]. The weather was every[illegible] I could desire, showery with [illegible] of fine weather; the bushes were full of young [illegible] worms thereon as I have never seen them [illegible] before. I tied bamboo screens together and covered over the plants as they stood in the open. The worms changed their skins at intervals of 4 to 5 days instead of 5 to 8, as had been the case when I reared them indoors on gathered food, and they spun their cocoons in 28 to 35 days instead of 40 to 50, as I had noted before. The moths came out of these cocoons in 27 to 30 days, and their eggs proved fertile, producing caterpillars which grew as fast and as large as the first. The only difference that I observed was that the 'cement' of the cocoons of the later crops was less uniformly white; this may have been due to the changes in the weather or the quality of the leaf, some shrubs having been eaten off three and four times this monsoon.

"5. The *Lagerstræmia* bush proved an excellent food; it flushed so quickly that a plant 2 feet high, after being fed off quite bare, cut back and re-potted, was again in thick leaf in a fortnight, and the same batch of worms stripped it again. In changing the plants, and in daily examining the cages, a few accidents occurred; but 100 worms yielded 71 cocoons.

"6. I enclosed an old *Carissa carandas*, which had neither been pruned nor manured, with bamboo screens, and liberated 50 worms there. In the course of a month I gathered 31 cocoons, a little larger than those of the *Lagerstræmia*, but much harder and yellower. The caterpillars seemed to thrive a little better on this bush, and completely stripped it, but the tree did not recover quickly, and did not yield another supply of food the whole monsoon.

"7. I put six worms on to a young *Zizyphus jujuba* tree in my garden, but neither enclosed it, pruned it, nor manured it. It had a great deal of leaf and flower on it, and the worms ate both. They grew very large and healthy, being in every stage of their existence a little ahead of some of the same batch feeding on *Lagerstræmia*. Five cocoons were spun here, larger than any that I had gathered from off the other trees.

"8. I let the majority of the moths fly away, for as soon as the male has left her, the female is quite ready to go and look for suitable trees to deposit her eggs on. I had not enough food for more than 100 worms at a time in my own compound, and almost every attempt which I made at bringing them up elsewhere, unsheltered by the screens, failed. Crows, squirrels, and other enemies carried them off, and I hardly got a single cocoon; but in my own compound I continued to rear a few at a time, changing them from one tree to another as I found it expedient. The result of the experiments which I made showed me plainly that plants in the ground, with or without screens over them, gave the most suitable food; that it mattered not whether the young shoots were eaten down by the caterpillars or cut off by the pruning shears. The *Lagerstræmia* never sprouted again, and it was only the very limited supply of food which I had that prevented me rearing many more worms.

"9. From the single experiment I have mentioned, *Carissa* does not seem to recover quickly. *Zizyphus* seems to grow very fast, principally at the extremities of its long straggling branches; but as I only had one tree in my compound, I could not be sure about its usual habit of growth.

"10. I baked some of the cocoons gathered from each of these three trees and sent them home to Mr. Wardle, asking him to give me an opinion on the qualities of the respective fibres. I had all the burst and injured cocoons cleaned, and sent them, together with those which Mr. Woodrow had on hand, to the Alliance Mills in Bombay to be converted into yarn. I have kept some fifty seed cocoons for next year's experiments.

"11. I have got together a good many plants for next season's experiments—353 *Lagerstræmia indica*, 10 *Lagerstræmia parviflora*, 18 *Conocarpus latifolia*; plants and cuttings all rooted and in leaf; also 136 *Carissa carandas*, 135 *Zizyphus jujuba*, 105 *Pentaptera tomentosa*, seedlings. There are besides 8 *Zizyphus* bushes in the compound, and if my gardener will but take care of these during my eight months' absence from Poona I hope to resume my experiments under better auspices.

"12. The past season has been very favourable for tasar worms. Mr. Lyle, who was cultivating them to a small extent at Dapuri in 1876, tells me that some of the men who were under him then came to him lately and asked him whether he wanted any more cocoons as they had seen several. He happened to be on the spot and sent a man to see how many he could collect within three hours. He came back with 800, and said that he had heard that some people had been taking them into Poona for sale, presumably to the native physicians. I myself have already found many more casually this year in the districts than I usually do."

* * * * * * * *

5. In Madras, in the North-Western Provinces and Oudh, in Burma, and in the Hyderabad Assigned Districts, as also in Mysore, there would seem at present to be no prospect of establishing any traffic in the cocoons or raw silk of the undomesticated worm.

6. The late Chief Commissioner of Assam thought that any attempt to foster the trade in Sylhet would prove unsuccessful, and refrained from offering any suggestions beyond drawing attention to the existing and old-established silk industries of Assam, which in his opinion might have opened up a wide field for private enterprise were it not for the extraordinary delays that exist in communications between the province and the rest of India. Government have under consideration the question of improving the facilities for communicating with Upper Assam. It is hoped that when the contemplated improvement is effected, Colonel Keatinge's expectations will to some extent be realised; for there is at least as great a demand in the European markets for the cocoon of the eria and moonga worm as there is for that of the tasar.

7. In Bengal the tasar worm appears to abound in various localities generally in all the tree and scrub jungle lying south and west of a line marking the southern and western limit of the continuous cultivation of the Gangetic alluvial and of the Orissa littoral. Whether the insect is of one or of several species, is a matter of doubt, and the season and mode of breeding and collecting appear to vary with the locality where it is found. The price of cocoons, it is alleged, ranges from Rs. 6 to Rs. 16 per kahan (1 kahan=16 pans of 80 cocoons each, i.e. 1,280 cocoons); and in regard to its yield, one kahan makes in Bancoorah two pairs of dhotees, in Sooree 15 chittacks of silk, and in the Sonthal Pergunnahs from 1½ to 2 seers. These and other more detailed particulars, furnished by the Government of Bengal though admittedly incomplete and unauthenticated in some respects, are useful as far as they go, and the Government of India will be glad to be informed of the measures which are being taken to gather further particulars, as well as of their results. The Lieutenant-Governor's opinion on the proposal made by Mr. J. Deveria, to the effect that the State should undertake the rearing of tasar cocoons in the jungle mahals of Chota Nagpore for sale to reelers and exporters is also awaited.

8. From the Punjab, some samples of tasar silk, reeled from cocoons produced in the Hoshiarpur district by the Deputy Commissioner, were reported on by the authorities whom the Government of India consulted as fairly successful. Some specimens of cloth, which were also received from Hoshiarpur, were found to have been very creditably manufactured.

9. The Secretary of State, in acknowledging in his despatch No. 25, dated the 22nd March 1877, the receipt of the cocoons gathered in the Central Provinces, has forwarded a report by Mr. T. Wardle, from which it appears that although the cocoons, when made over to the filatures in France and Italy, were found to be very old and imperfect, the reelers spoke most hopefully of the results that might be attained with fresher cocoons properly gathered and prepared. Mr. Wardle, too, said that he was prepared to dye tasar silk as reeled in Europe by his improved processes in almost any colour, even to very pale shades.

10. The first part of a further report from Mr. Wardle has meanwhile been received under cover of the Secretary of State's despatch No. 61, dated the 29th August 1878; as also some samples of tasar silk displayed at the Paris Exhibition, as prepared under Mr. Wardle's instructions. These specimens, which can be seen at the office of this Department by persons interested in the matter, are far superior to anything ever yet seen of the same kind, the organzine especially being remarkable for its excellence. The grége is softer, cleaner, and altogether better than the best raw tasar silk as yet reeled. It is clear from these samples that such difficulties as existed in the reeling of this silk have been completely overcome. Mr. Wardle's process produces silk so fine as to be capable of adaptation to any purpose for which mulberry silk is used. Excellent results have also been obtained in the spinning of tasar thread and the weaving of fabrics from spun silk. Mr. Wardle's experiments with the dyeing of the silk have also been quite successful. On the whole it is certain now that there is no inherent obstacle to the utilisation of this silk for manufacturing purposes.

11. The main question now to be answered is that of cost. Whether silk of this kind will be extensively consumed, depends upon the price at which it can be placed in the market. Mr. Wardle states that the cost of making organzine and tram from the cocoons is 20 francs the kilogramme, viz., 10 francs for reeling and 10 francs for throwing. This is double the price at which ordinary tasars are now sold, and it is not easy to say whether purchasers will be found for the improved product greatly superior as it is, though it seems that the price is susceptible of reduction. As yet the only indication of the prices likely to be given for tasar silk is an offer made by M. David, a silk manufacturer of St. Etienne, who expresses his readiness to take one or two thousand kilogrammes of cocoons delivered at Marseilles at the price of one franc the kilogramme. This price, it is clear, is much too low, for, according to the information before the Government, cocoons could not probably be laid down in Europe at less than three or four times the sum mentioned. This, however, is a matter which admits of local verification, and it should form the subject of enquiry.

12. The results obtained by Mr. Wardle, as well as by others working independently, are so important and so full of promise as regards the manufacture of this silk and the utilisation of the manufacture for apparel and other purposes, that it is eminently desirable to thoroughly investigate the question of production. Information on this subject has been sought from various quarters, but information in the possession of Government is not sufficient to enable it to furnish precise answers, yet it is necessary, if the attention of capitalists is to be attracted to the development of this industry, that full information should be forthcoming. M. Natalis Rondot, a delegate from the Chamber of Commerce of Lyons to the Paris Exhibition, and President of the Jury in the Silk Section, has written to the Government of India, asking for information on the following points, not only as regards the tasar worm but also as regards other undomesticated worms:—

(1) an enumeration of the different kinds of wild worms;
(2) the districts from which each kind is obtained, and in what quantities;
(3) the species of worm from which each kind of silk is manufactured;
(4) the trees on which the worms feed;
(5) the uses to which the silk is put by the natives;
(6) the markets where they are to be purchased;
(7) the probable prices of dry cocoons of each kind and of the silk as reeled by the natives;
(8) the probable quantities retained for local consumption and available for exportation to European silk mills;
(9) and the outturn in money value of the silks woven in India, which Rondot thinks must be considerable, especially if tasar and other similar silks commonly worn by the natives are taken into account.

13. M. David, of St. Etienne, also asks for information on the following points:—
(1) the nature of the chemical agent used by natives to soften the cocoon;
(2) whether the natives can reel a cocoon more than a year old;
(3) the length of time elapsing from the spinning of the cocoon and the emergence of the moth;
(4) whether the dark and light coloured cocoons which are found mixed in the bales sent from India are of different varieties, and whether they are found in the same localities;
(5) also, whether it would be possible to obtain bales containing only light coloured cocoons.

14. Some information but of a vague and general kind, exists on a good many of the points enumerated by M. Rondot, and the Governor-General in Council desires that an effort may be made to cause such specific information as is obtainable, with special reference to the quantity obtainable, and the prices on the spot, to be furnished with as little delay as possible. It is also much to be desired that particulars of manufacture should be obtained as far as possible.

The particulars of the outturn of the filatures in Bengal are unknown; for, though the quantities exported and their values are ascertainable, Government is unable to say how much of the outturn of the filatures (there are a great many native filatures) is kept in the country, or what it is worth. Of the small local native reeling (small separately, but large in the aggregate), no more is known than of the handloom village weaving of cotton. In Assam and Burma, silk reeling and weaving are a domestic occupation of the women of the house; in other provinces it is a trade. In Bombay, there are two mills worked by steam in which silk is woven, but the extent of their operations is unknown. In short, no precise statistical account of the silk industry in India is extant, though there is a good deal of information of a more or less vague and general character. As regards silk production, Mr. Geoghegan's account of silk in India contains practically all the information that Government possesses, although for some years past much attention has been paid to the production of tasar silk. The same is to be said of the other kinds of wild silk. These are all separately distinguished and shown in Mr. Geoghegan's book, in the section given to the wild silk producers, as well as in the appendix by Captain Hutton. Interesting information, though in most cases of a general character, has been furnished by the local Governments and Administrations, but more precise information is now desirable, and the Government of India will be glad if the Government of Bengal and the Chief Commissioners of the Central Provinces and Assam will take measures to collect it, and furnish a report giving a categorical reply to the enquiries of both M. Rondot and M. David.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV. CALCUTTA : MONDAY, 2ND JUNE, 1879. No. 6.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

CORRESPONDENCE.

SWAMP CULTIVATION.

TO THE EDITOR.

SIR,—I wonder if the scientific agriculturists who bewail the degraded state of agriculture in this country and speak so contemptuously of "swamp cultivation" have ever realised the fact that the best rice land in Tinnevelly (and I dare say elsewhere) produces *every year* without fail 3,654lbs. of clean rice; and not only shows no tendency to deteriorate but often produces a crop of pulse in addition. To enable any one to check my figures I will give the details of the calculation. 40 *kottais* (a local measure containing 168 *pucka* seers) is not an unusual crop for a *kottai* of the best double crop land. A *kottai* of land is equivalent to 1·62 acres: so that an acre would produce 24 11/16 *kottais* of *paddy*. It is considered here that 21 measures of paddy will give 9 measures of cleaned rice *after paying all charges of cleaning*. At that rate 168 *pucka* seers of paddy would yield (3×24=) 72 *pucka* seers of *rice* or about 148lbs., this multiplied by 24 11/16 gives the number of lbs. per acre as shewn above. Expressed in imperial bushels (of 60 lbs.) the yield would be 61¾, and it must be remembered that this is practically a *never failing* crop, and that very often a crop of pulse is reaped between the two crops of rice.

I may add that an ordinary rent per acre for the best land is 13 *kottais* of paddy, which at present prices is worth Rs. 104 to 130, or 4 to 6 times the assessment including all cesses.

TAMBRAPARNI.

THE SAGO PALM.

(*To the Editor of the "Straits Times."*)

SIR,—A great deal of attention has been drawn to the East lately on account of the high price of land in Ceylon and India. Cheap land can be got in Sarawak in any quantity, and land too particularly suited to the culture of both tea and coffee, but I wish to point out to your readers a new culture which is doubtless far more profitable than either, that is sago.

The sago palm grows to perfection in Borneo. At present the planting is entirely in the hands of natives and the manufacture in the hands of Chinese. To give to your readers some idea of the extent of this culture in Sarawak, I may mention that our trade returns for last year shew an export of six thousand six hundred and ninety-five tons of manufactured sago, value four hundred and nineteen thousand, nine hundred and fifty-nine dollars.

I shall now give estimates for a plantation on a comparatively small scale, and as I have given the matter careful study the figures and facts given may be relied upon.

Estimate for a sago plantation of 500 acres.

To price of 500 acres of land	$ 500
Felling and clearing @ $4 an acre ...	2,000
Planting @ $1 per 100	250
Carriage do	950
26,000 pieces of Billian fencing	780
Putting up do @ 5 cents per fathom ...	160
Coolie house, tools, &c.	100
	$4,040
Interest on do 10 years @ 10 per cent ...	4,040
Mandore and 10 men say $60 per mensem	7,200
Interest on do	3,600
	$18,880

The best distance to put in the plants is about 30 feet apart; 500 acres would therefore carry about 25,000 trees. At the end of ten years

there would be, say 15,000 trees fit to cut; natives are in the habit of working up trees at half profits, and as each tree will yield an average of 5 pasus or 2 pikuls of raw sago, always worth in Sarawak $1, the profit the first year would exceed the whole outlay, and the plantation should continue to yield a profit of from $ 15 to $20,000, or about three thousand pounds sterling yearly. As it might be difficult to get natives to work up such a quantity, the better plan would be to erect machinery for pulverising the trees and for the manufacture of sago flour for either the Singapore or European market, when the profits would be considerably larger.

I fear my figures will shew such a profit that your readers will say: "If it is such a good thing how is it Europeans have not taken it up?" I can only conclude that partly want of knowledge of the profits, partly the long time that must elapse before any returns may be expected, and partly the fear of depredations of the wild pigs may have deterred them. It will be seen in my estimates that a Bilian or Iron wood pagar is a considerable item. I make this a *sine qua non.* If this fence be so closely and strongly made as to keep out the pigs, there is no fear of the success of the scheme as the palm will require little or no looking after.

In some ground the sago tree comes to maturity in 8 years, and as each parent tree is surrounded with young ones which ripen in due succession, a sago plantation once made will never be exhausted. I may mention that Bilian wood is impervious to the attack of either white ants or rat, and will last 200 years. In this culture there is no fear of either long draughts, heavy rains, or violent storms damaging your plantation as in tea and coffee. The only drawback is that the best sago lands are found in low lying swampy ground which makes working the plantation anything but a pleasant occupation. Such lands are in fact scarcely fit for any other culture, and we have no doubt the Sarawak Government would gladly make free grants for such a purpose.

The larger the plantation the greater the proportion of profits.

I am, &c.,
W. M. COOCKER,
Resident of Sarawak Proper.

THE PRICKLY COMFREY.

(*To the Editor of the " Times of India."*)

SIR,—Having noticed letters in your paper regarding the "prickly comfrey," I should feel obliged by your inserting this letter also, which I trust in time may be answered, giving me the information I seek about the plant as a forage for horses. The circumstance which has prompted me to write is as follows:—

A short time ago, in this station, a tonga pony had been daily getting a bundle of "prickly comfrey," and being the only animal in the stable that relished it, got the whole bundle, which in size was about as much as one could grasp in both hands; but it evidently did not agree with the pony, as it brought on indigestion, which ended in sleepy staggers, and he died on the fourth day after the staggers came on, having been in a perfect state of coma for some ten hours previous to death. The symptoms in the case were so very marked that there could be no mistake as to the ailment; and the treatment was carefully carried out. I should mention that the pony was a Deccanee, hardy and strong in constitution, and had done regular tonga work for some time past. The owner could ascribe no cause for the pony's illness other than the "prickly comfrey," and as I had the case under treatment, I feel sure that the cause assigned is the correct one. I am well aware that forage to which the stomach is unaccustomed (although wholesome of its kind) will produce indigestion in the horse; yet I cannot think that the bundle the pony got daily was too much, if the plant is a wholesome forage. I should very much like to know if the "comfrey" is considered a wholesome forage for horses, and if so, how much of it can be safely given? Is it necessary to dry the leaves a little in the sun before giving them to a horse, or to prepare them in any way? And, also, at what stage of the plant's growth should it be cut for forage?

B. G.

Hingolee, 8th May, 1879.

BAMBOO CULTIVATION.

(*To the Editor of the " Englishman."*)

SIR,—Referring to Dr. King's letter in your journal of the 6th February, as I understand the question at issue between him and myself, it is as follows.

In February 1876 experimental plantations were ordered to be established by the Government of India for the purpose of testing the cultivation and cropping of bamboo, and in a "memorandum" then officially issued by Dr. Brandis the Inspector-General of Forests, he directed attention to the main points to be determined thereby; among other suggestions in this "memorandum" Dr. Brandis clearly pointed out "that the experiments undertaken *should be as much as possible comparative*; of a number of clumps of the same age, and species, and growing under the same conditions, *some should be thinned lightly, others heavily, and the third group should be cut completely, leaving only a few old stems on the ground.*"

Now what was the course pursued by Dr. King?

Did he adopt *any one,* of these *three,* most practical and common sense suggestions?

By no means:—but on the contrary he confined his experiments to "*one single faulty system*" which he terms "Utopian" *i.e.*, chimerical, adding, "nobody can have a poorer opinion of the merits of the system which was followed in this experiment than I myself have."

To justify his failure (which I very naturally I think criticised) he now wishes to "*father*" this system on me, and to substantiate this quotes *ingeniously*, but not *ingenuously*, from my pamphlet:—I say *ingenuously* as although professing to quote textually (from page 7) six consecutive paragraphs bearing on the point, he has left out 1, and that the most important one, the back-bone indeed of what he is pleased to call "*my system*" (The Play of Hamlet in fact, with the part of Hamlet left out) *viz* that following "in a similar manner osier beds in England." "I have mentioned the latter as in order to stimulate a "rapid, aqueous and sappy growth, as also to provide for the dry "seasons common to hot countries a system of irrigation would be "necessary, such a system indeed being at present practised with the "sugarcane in Egypt, Spain, and elsewhere.

Long before my pamphlet was published however in January 1875 I addressed Dr. King requesting his advice and opinion in bamboo cultivation, and cropping, giving my views *in extenso*, and stating that I considered irrigation an essential, quoting rye grass under irrigation in this country in illustration, but to this letter I received no reply till June. In reply, having then learnt that experiments would be instituted to investigate the bamboo industry I proposed, I addressed another lengthy letter to Dr. King suggesting that *various systems* of cultivation and cropping should be tested, sending him an account of the manner in which the bamboo when cultivated for paper was treated by the Chinese from which I extract as follows:—

"To cause it (the bamboo) to produce an abundant crop for many "years, the *sprouts* must be cut some distance from the ground; if "they are cut on a level with the earth the plant would be entirely "ruined, perhaps because the shoots being entirely stripped, would no "longer be preserved from the burning rays of the sun, or because the "branches and the leaves which grow in abundance round the foot of "the plant cannot receive nourishment any longer from the air, and "have therefore none to furnish the roots."

Dr. King did not acknowledge this letter, neither did he favor me with any further communication, but as he had ample time to consider the subject before he instituted the experiments ordered by Government, which were not commenced before June 1876, it is very difficult to understand *his system* of procedure, and still more so his reasons for confining himself to "*the one single system*" which he condemned as "Utopian," as also why with that conviction he he should not have simultaneously tested at least one, if not more, of the three alternative or comparative systems recommended by Dr. Brandis even if he disdained to test the system pursued by the "poor Heathen Chinee." This however lies with him to explain.

In spite of the failure of Dr. King's experiment, I must not say experiments, *as unfortunately he only made one*, I have no fear of the future of bamboo, indeed I am glad to see from his letter that even Dr. King admits—"that young bamboo shoots may one "day become an article of export" but why he should say it would "be more profitable to growers to sell their bamboos mature, than "to dispose of them in the succulent stage" I confess I do not understand, this being much on a *par* with saying that it would pay better to sell sugarcane for chewing than to make sugar from it, or to grow asparagus or cabbages for their seed instead of eating them.

Dr. King recommends "my directing my inventive powers to utilising mature bamboo stems." Why should I do so? especially when after full investigation I have found that the young shoots are so vastly superior in every respect for paper stock, the reason of which I have fully explained in my Pamphlet, as also in my letter to Dr. King above referred to, shewing that matured bamboo stems are wood, and very hard silicified wood too, being wood, they must be treated as wood, but then paper makers do not want wood, and if they did, can procure it from Sweden and Norway nearer home, and cheaper, than importing bamboo wood from India.

I regret as Dr. King remarks "having had so little opportunity "of acquainting myself with the peculiar growth and cultivation of "the plant" I can only therefore rely upon the opinions of practical

botanists, and others, who have, and the more the question is investigated the stronger becomes my conviction that bamboo in India has a great future, and that my calculations as to the cost and facility of producing the young stems suitable for paper stock if judiciously conducted in plantations will not be found very erroneous; if collected from the native forest or jungle they would necessarily be dependent upon locality, cost of carriage, &c., &c.

I believe Dr. King has been misinformed as to the Chinese employing mature bamboos for paper, except possibly for coarse packing paper, the extract I have quoted shows the plant is carefully cultivated for cropping the young "sprouts" or "shoots," and if Dr. King had followed *their system*, instead of cutting down every stem, both old and young, as well as every twig produced, he would not have had to *chronicle a failure.*

THOS. ROUTLEDGE.

Claxheugh, Sunderland,
6th March 1879.

CHEMISTS' VALUATIONS OF MANURE.

(To the Editor of the "North British Agriculturist.")

SIR,—This subject has recently attracted so much attention that I think the following facts will be read with interest by all concerned, and may be safely left to speak for themselves, which they do far more eloquently than any amount of argument on one side of the question or the other :—

We recently received from one of our agents a complaint that some dissolved bones which, prior to their leaving our works, had been analysed by our chemist and found to contain—

20·41 soluble phosphates ;
17 08 insoluble ,,
2·68 ammonia—

had been analyzed for the purchaser by Mr. Stevenson Macadam, with the following result :—

Soluble bi-phosphate of lime	18·56
Equal to bone phosphate rendered soluble	(21·16)
Insoluble phosphate	15·52
Hydrated sulphate of lime	35 83
Alkaline salts	2 14
Silica	0·32
*Organic matter and moisture	14 88
Moisture	11·76

*Ammonia, 1·63

STEVENSON MACADAM, PH D.,
Lecturer in Chemistry.

Second-class dissolved bones and value on association standards—£6-18s. per ton cash at principal seaports.

Not being satisfied with Dr. Macadam's analysis, we requested the purchaser to send a sample to another chemist, and suggested Mr. R Carter Moffat, whose analysis showed it to contain :—

Bi-phosphate of lime	14·74
Equal to soluble phosphates	(23 10)
Insoluble phosphates	14 50
Sulphate of lime	29 40
Sand	3 12
Alkaline salts	1·23
Organic matter, water, and ammonia	37 01
	100 00
Ammonia	2 70
Equal to sulphate ammonia	10 51

Remarks.—This is an excellent manure. It is in fine condition, and contains a satisfactory proportion of phosphates (soluble and insoluble) and ammonia. It will prove a good and permanent fertiliser. Calculated value to the farmer per ton, exclusive of bags—£8 10s.

R. CARTER MOFFAT. Ph. D.,
Analytical and Consulting Chemist.

The buyer was naturally surprised upon receipt of this analysis to find two chemists differing so widely, and accordingly determined for his own satisfaction, to send a further sample to a third chemist, and he selected Mr. R. R. Tatlock, whose analysis shows :—

Bi-phosphate of lime	14·71
Equal to soluble phosphates	(23·04)
Insoluble phosphates	12·05
Ammonia	2 50
Equal to sulphate of ammonia	9 70

R. R. TATLOCK, F.R.S.E., F.C.S.

This analysis was accompanied by the following letter :—

Please find enclosed certificate for analysis of dissolved bone. Although I don't consider that it comes within an analytical chemist's province to fix the money value of the article which he analyses, I may say that a farmer should be able to purchase the manure (delivered) from any respectable manufacturer at a maximum price of £8 per ton.—Yours faithfully,

R. R. TATLOCK.

Putting all other discrepancies aside, although it will be seen they are not inconsiderable, it was evident from the composition of the manure, as well as from our own analysis and those of Messrs. Moffat and Tatlock, that Dr. Macadam had made a serious error in the determination of ammonia in this sample. We therefore wrote to him, and received the following reply :—

11th April 1879.

DEAR SIR,—I am favoured with yours of yesterday, and am perfectly certain that the results of the analysis you refer to, as detailed in my report, are correct.—Yours sincerely,

STEVENSON MACADAM.

The Lawes Chemical Manure Co.

The above is not an exceptional case, as most manufacturers can testify, and I trust that you will do us the favour of publishing it, in order that farmers may see and understand the difficulty in which a manure manufacturer is placed when analytical chemists not only make serious mistakes in their determinations, but, to use Mr. Tatlock's own words, 'Do that which does not come within their province'—*viz.*, fix the value of articles sent to them for analysis—I am, &c.,

T. ELBOROUGH,
Manager and Secretary to
Lawes Chemical Manure Co., Limited.

THE ALLEGED EXCESSIVE USE OF ARTIFICIAL MANURES.

(To the Editor of the "North British Agriculturist.)

SIR,—Professor Walley, of the Edinburgh Veterinary College, proclaims the ignorance of such men as Lord Polwarth, and other no less distinguished agriculturists, who advise increased production as one mode by which the depressed state of agriculture may be eased. Of course it is not by stating the self-evident objection, that before you can increase the produce of the land you must lay out money on it; and where is it to come from when tenants have nothing on the farm to sell, or at their bank account? It is by the consoling remark, that even though the tenants had the money it is bad policy to increase the produce of the land, because artificial manuring and artificial cultivation produces many forms of blood depravations, and deteriorates animals fed on the crops so raised, and that animals so fed on the produce of many thousand acres of land, highly cultivated, get weakened in their tissues and liable to disease. In case there should be any mistake, allow me to quote the following sentence :—' There are many thousand acres of land which could be made to yield more abundant crops, without damage either to the land itself, or to the animals deriving support from its products.' But there are many thousands more in which forced culture has been pushed to an absolutely injurious degree, not only to the animals, but also to the land.

On no land has forced cultivation been pushed to a higher degree than in the high-rented land within three miles of Edinburgh. As Professor Walley practices in Edinburgh, it is to be supposed this is the land he alludes to. Well, the produce of no land in Scotland fetches higher prices, and none is more prized by the buyer, and, I venture to say with all deference to the learned professor, the land in question produces crops which, take them all in all, are not only in quantity but also in quality unsurpassed by the producers of the lower-farmed land which he estimates so highly. Had the professor alluded to the produce of the irrigated meadows around Edinburgh, where for nigh a hundred years the older portion has been fed with the rich excreta of the inhabitants, there might have been some grounds for believing that forced stimulation has been carried too far. He, however, makes no allusion to these excessively stimulated lands, but alludes to overdoses of nitrate of soda to grass land as being productive of diabetes. To many farmers this will be news. I have often seen as much as 8 cwt. of nitrate of soda applied to grass for soiling, of course at different times, and finer, more wholesome, or more nutritious food could not be wished. If the grass was cut dry, however luxuriant, the cattle and horses throve on it when given in reasonable quantities; however large the crop, no bad effects ever followed. While I have seen from poorly grown and badly got hay, when no nitrate of soda was used, frequent cases of horses suffering from diabetes. Indeed, badly saved and musty hay of all kinds, when given to horses, are followed frequently by diabetes.

I should like to ask Prof. Walley how it happens that beautiful, long green Italian rye grass hay, which has been raised by the application of nitrate of soda, not only sells for the highest price in the market, but gives most satisfaction to the *horse-keeper?*

I should also like to ask the professor how it happens that we hear so little of blood disease from the animals fed on the produce of the Edinburgh irrigated meadows, where, if anywhere, over so long a period, such an enormous supply of forcing, stimulating manures have been applied, and where such an excessive weight of high stimulated grass is raised ?

I should also like to ask the professor how it happens that high manuring and skilful cultivation which increases the produce of the land also deteriorates the land ? and, further, how it happens that land that has been so treated fetches very much larger rents than land not so cultivated, when it is offered for leasing ?—I am, &c.,

A TENANT-FARMER AND NO VETERINARIAN.

KOTEGHUR NOTES.

SIR,—The weather has continued dry during this month. The rainfall has been very slight. We see clouds roll up from the plains but they all pass over us—being interrupted by the Hattu range—and go on to the higher ranges. We have the haze now, and while this lasts, heavy rain cannot be expected, though we shall have light showers, as the heat—the cause of the haze—prevents the clouds from descending below the (Hattu or Whartu) second range. The first day of the month was bitterly cold, but more seasonable weather soon came on. The following is a comparative table of the past five seasons :—

	April.				
	1875.	1876.	1877.	1878.	1879.
Snowy days...	...	...	...	...	...
Haily „ ...	...	...	1	4	...
Rainy „ ...	1	4	16	11	7
	Very dry and hot. Cereals suffered.	Bright and pleasant.	Very damp: ground quite soddened with the heavy wet.	Damp during first half: thunder and lightning accompanied the rain.	Dry, though very hot. Cereals suffering.

The wind has been in all quarters, not appearing to know in which one to settle for even for a short time. It very much resembled a lady going into a draper's shop to buy a yard of ribbon, she manages to turn the place upside down, and walks out without purchasing anything. When the wind began blowing the weather-wise would prophecy " Ah ! this is the right sort of breeze ; we shall have rain before to-morrow morning ; " but they were as much out as the store-keeper who expected to see the lady's coins pass across his counter, for none came.

The thermometer (Fht.) hung in an open verandah, W. aspect, is about 57° in the morning, 66° in the evening ; lowest 48°, highest 72°. Out in the sun it has reached 133°.

The catkins of the poplar (vern. *chalou*) ; the leaves of the horse-chestnut (vern. *kanúr*), and elæagenus (vern. *gihain*), oaks, chil, mulberry (vern. *chmu*), and a rhus (vern. *titri*) the latter the last tree to come into leaf—are now out. The horse-chestnut is now blossoming, and in a week's time will be in full beauty · the spikes of variegated flowers presenting a magnificent appearance ; a tree then resembles a large chandelier with its long spikes of flowers tapering up from amidst the foliage like so many wax lights. The purple coloured berries of the *Princepia utilis* (vern. *bhekul*) are now ripe, and the village children are busy collecting them to press into oil for cooking purposes. The yellow flowers of the barberry (vern. *kamashal*) ; the magenta ones of the wild indigo (vern. *loon*) . the white ones of the clematis ; the light brick-red of the wild sorrel (vern. *malera*), in which, at a little distance, looks like a heath ; the *yellow potentilla* ; the *white potentilla* ; the wild syringa (vern. *kandi*) with its delicate white flowers ; the Himalayan honeysuckle (vern. *khuati*) with its small yellow and white blossom ; the wild strawberry with its white flowers ; wild sage ; wild thyme, these and many other wild flowers too numerous to mention here are now making our fields and hedges gay with their brilliant colours. The wild roses—white and pink—are budding, and will be in splendid profusion next month. Bergamot springs up.

The monaul pheasant now becomes very shy : the argus pheasant has begun to pair ; minas are in plenty, monkeys have arrived from the lower hills and are making free with the ripening barley. The roe fish is in season, some of them 10 to 12 lbs. in weight : they sell at about one anna a pound, although travellers will be asked four times that sum.

The price of food grains is about the same kept up through the instrumentality of the Government officials who are large landed proprietors and therefore interested in keeping up the value of food grains.

The barley harvest is late this year in spite of the early and warm spring we have had ; in 1878 it was reaped on the 20th of this month, the same field will be fully a fortnight later. The villagers have sown eleusine corocana (vern. *kaoni*) ; upland rice (vern. *rause dhan*) ; paspalum sp. (vern. *kodra*), and hill dall (vern. *bhernu*). Poppy (vern. *fim*) ; and lentil, (vern. *masur*) are in flower, and being weeded ; these two crops are grown together as a mixed crop.

The fruit of the walnut, apricot, and peach are forming, the china-tallow tree is leafing. A neighbour of mine, a well-known horticulturist, is trying the experiment of growing oranges in the open air ; I doubt the success of the experiment as the elevation is too great ; the trees will thrive but the fruit will not ripen, as the extreme vertical range of the orange region of the tropics is 4,000 feet, having a southern exposure ; however, the experiment is worth trying, and if it can be made to succeed, he will do so ; and then there will be real orange blossoms for the use of the future brides of this increasing neighbourhood : I need hardly inform you that orange-blossoms are emblematical of fruitfulness, hence their appropriateness as the decoration of a bride.

Potatoes sown in October, November and December last, only sprouted this month, owing to the dryness of the past winter. Other potatoes sown last month are also sprouting, so that no time has been saved by planting these tubers in the autumn. My idea was to sow monthly from October to March as in England—so as to obtain a succession, but the experiment, from want of rain at the proper time, has proved a failure.

Single stocks ; pansies, iris, roses in profusion. Asparagus, water-cress, cress, radishes ready ; lettuces transplanted ; beans, and peas sprouting, other flowers and vegetables progressing satisfactorily.

G. P. P.

Koteghur, 30th April, 1879.

The Indian Agriculturist.

CALCUTTA, JUNE 2, 1879.

THE ETCETERA DEPARTMENT.

NINE separate departments occupy the activity of the Director of Agriculture and Commerce in the North-Western Provinces and Oudh. He has two botanical gardens, one experimental farm, one sewage farm, one horticultural garden, two tobacco farms, one orchard, one stock farm, one silk farm, and all the estates under the Court of Wards. The botanical gardens are described as a " national heirloom," and it is considered (by the Director) due to the dignity of the province that money should be granted ungrudgingly to keep them up. Unfortunately these are not days in which money is to be had for the asking, and botanical gardens must take their chance along with public works. Mr. Buck, however, knows how to work them without absolute dependence on a penniless Government. He has managed to drain the grounds with the sale proceeds of felled timber. Economy is also to be consulted in the arrangement of the gardens. " There is no public," it is justly remarked, " as in Calcutta or London, for whom to make scenic effects"; and expenditure on mere beautification has therefore been discontinued. The gardens are to serve the purpose of a collection of the products of Northern India, and also such products of other climates as can be successfully grown here ; utility, not curiosity, being the guide of choice. These however are mostly anticipations of the future. Hitherto the gardens have done little good. Saharanpore seeds have got a name for not coming up ; and Mr. Buck says he is not surprised at it. A practical gardener is wanted. The gardens enjoy the blessing of a superintendent, but it seems that he is not a practical gardener. In short, so far as regards botanical gardens, the main thing to be said is that little or nothing has yet been done. Arboriculture was supposed to be an important function, as was also the propagation of fruit trees but a more intimate acquaintance with the gardens has proved these opinions to be erroneous. " Foresters had been trained at Saharanpore, but the training was not of the kind required." No rational being

can suppose that Saharanpore will ever supply trees for the arboriculture of the province. Roads and canals are the two great spheres of tree-planting; and for all practical purposes it is much better to get young trees in the district than to send for [illegible]. If the Agricultural Department is to take an interest in arboriculture, the plan followed should be the simple one of worrying district officers till they can shew avenues of trees along all their roads. This, indeed, is an object which is worth attending to. Comfort to travellers would not be the only advantage. The country is beginning to feel the want of the groves which have been driving our railway trains so many years; and disastrous variations in the rainfall would not improbably become less frequent if denudation were steadily compensated by new plantations.

Experimental farms have this casual similarity to gardens, that their annals for the past year are a blank. "The drought destroyed the value of field experiments." It appears that the Secretary of State, when called on for practical farmers, sent out gardeners, who have been got rid of with some difficulty. "The last one, who was useless except to grow roses, resigned under compulsion, and the farm has since been under the temporary management of an indigo-planter." If, however, there are no experiments to record, one cannot complain of want of energy in the manufacture of ploughs. From America, from England, from Bengal and Madras, ploughs have been collected and collated, and two promising selections have been made. The reformation of Indian ploughing is beset by a number of difficulties which appear ludicrous, but are really formidable. Native cattle are trained to turn round in the opposite direction to that required by the English plough; and of course the share of the improved plough must be made to suit these animals' notions. Then, the cultivator prefers carrying the plough a-field on his shoulder, so it becomes necessary to keep down the weight as much as possible. The custom, indeed, is one which obtains also in countries much nearer home. It will be remembered that among the evil omens which met the Knight of La Mancha as he set out on his last disastrous expedition, one was a country-fellow going to his work with his plough on his shoulder. In India, as in old-world Italy, it is a common sight to see

Fessos vomerem in versum boves
Collo trahentes languido;

but though the bullocks always drag the inverted plough home in the evening, it would offend all rule and custom to make them drag it out in the morning. Again, the plough must be short, so that the cultivator may get at the tails of his beasts, since it is only by manipulation of this organ—wrenching, pulling, and twisting—that man can overcome the Indian bullock's tendency to stand still. Finally, it must be cheap, and adopted to a small and weak breed of cattle. All these points have been more or less provided for, except the great tail difficulty; and even this is said to have been conquered by a certain "subsoiler," the work of an ingenious Mr. Macrae. Having got ploughs, the next step is to make the natives use them. What with Court of Wards estates, and intelligent zemindars, and amateur farming Collectors, a good many ploughs have been set going already. As for what may be expected, we may quote the Director's own words: "The question [of an improved plough] is of the very highest importance to the country, if it is true that a larger amount of food-crops can be raised by its means throughout India; and I cannot but insist that the natives' verdict in this respect will be the surest. . . . It may safely be promised that they will, if the produce is larger, take to the use of any plough which is adapted to *their* labour and means." After this comes a little paragraph telling us that the net cost of the Cawnpore farm was only Rs. 1,837 in the year under report. So much can be done by zealous and clever management. Not less noteworthy in this respect is the sewage farm at Allahabad, which pays its way already, and will shortly bring in some Rs. 10,000 a year to the Municipality. Such an example cannot fail to be of value. If municipal conservancy can be made self-supporting, a most welcome relief will have been given to Municipalities, in these days when the main source of their income is threatened with abolition.

Tobacco is evidently the pet child of the Agricultural Department. Vast possibilities here disclose themselves. In the foreground of the picture is seen the flourishing cultivator; in the remote vista floats a vision of a new source of revenue; while wealthy planters and cheap cigars fill up the rest. Private enterprise is the means by which we must hope to see these good things brought to pass; and it speaks volumes for the Director's practical wisdom that he has chosen from the beginning to work the experiment through a private firm, "who, while they have connections in the trade in England and America, have not to ask the leave of half-a-dozen authorities when they want a new curer." The results are still uncertain, but general hopefulness prevails. It is necessary to remember that more than two years elapse before the crop sown is ready to do justice to itself in the home market. Patience seems to be the one thing needful. Already a few samples have fetched two-thirds the price of American tobacco, and three times that of any Indian tobacco hitherto tried. An attempt to induce the troops to use Ghazipore tobacco was not successful; but neither were the first efforts to introduce Indian beer, which now commands so extensive a market. It is understood that the new tobacco does not find encouragement in official quarter in England. There are other conceivable reasons for this than any real inferiority of the article. Moreover, it seems more than probable that a change in climatic conditions will greatly increase the chances of success. A new farm has been started near the Tirhoot frontier, in a Bengal climate, and already promises to eclipse the parent farm at Ghazipore. Experiments have also been begun in Kumaon. It will go hard if some striking results are not chronicled within the next two or three years. Kumaon has also been selected for orchard-planting on a large scale. It was Sir John Strachey who first called attention to this favoured region, while he was Lieutenant-Governor of the province. In fact, as all the world knows, the Agricultural Department was the work of his hands. The special connection of Kumaon wth this Department consists in the endless variety of soil and climate presented by those wide and picturesque highlands. Tea has already begun to rank as a staple; and Sir H. Ramsay is resolved that fruit-trees shall follow. A happy thought comes from the Pyrenees. Chestnuts provide the greater part of food there; why should they not be equally useful in the Himalayas? Apricots and apples have proved a decided success, but for want of systematic development, we have to pay sixpence a piece for apples in Nynee-Tal, while Cabul merchants can sell them *in the bazaars below* for half the price. Native enterprise is of course quite unequal to a business of this kind, where the existent demand is practically *nil*, and the returns to capital invested are problematical and distant. When Government orchards have proved that fruit-growing is a paying speculation, we may look to private enterprise to do the rest, as was the case with tea cultivation in the Dhoon. Amidst rumours of bankruptcy and distress, it is immensely refreshing to find all these new resources only waiting to be developed. Far be it from us to hint discouragement. We have faith in Mr. Buck, and believe that he is doing good and earning fame.

AIR AND WATER AS SOURCES OF PLANT-FOOD.

THERE is no such thing, in nature, as absolutely pure water. The waters of wells, springs, tanks, drains, brooks, rivers and the ocean, are charged with a great many different kinds of matter which water takes up and carries with it wherever it flows. Absolutely pure water can be obtained only by distillation; and even distilled water, if left exposed to the air, will gradually have mingled with it many substances borne by the wind and carried into it by rain. Chemists have analysed all kinds and qualities of water, and they find, that putting aside impurities, absolutely pure water can be separated into two and only two substances, which cannot, in the present state of science, be further divided and are on that account called *elements*, because nothing else can be obtained from them. These elements are hydrogen and oxygen, both of them gases at the ordinary temperature and pressure; and both very widely diffused in nature. Everything in the world, whether animal, vegetable, or mineral, is found by chemists to consist of substances which cannot be further reduced or made more simple

These simple substances of which all material things are built up, chemists have agreed to call *simple bodies* or *elements*, and the whole number of these, which science has, as yet been able to discover, does not exceed sixty-three. It has also been found that the greater part of every living thing, whether plant or animal, is composed of only four of these elements, *viz.*, carbon, hydrogen, oxygen and nitrogen. These are sometimes called organic elements ; and sometimes *organogens*.

In like manner it has been found that air, when perfectly pure, consists chiefly of the elements oxygen and nitrogen in the proportion of about one to four by bulk. These gasses are not in any way combined, they are simply mingled together much in the same way as milk and water may be mixed mechanically together, the water having no effect on the milk except to dilute it. Nitrogen acts the part of water to the oxygen of the air, dilutes it, robs it of more than half its strength. Were our atmosphere composed entirely of oxygen, the whole world and the beings that inhabit it, would present a totally different appearance to what they do at present. The circulation of animals would be doubled or trebled; muscular action and thought would be much more energetic and rapid ; and life probably worn out in a much shorter time, the vital forces would be used up by excess of oxygen. The effect of a pair of bellows on a low fire is well known. A smart current of air is forced among the embers ; and in this way a much larger quantity of oxygen than usual is brought in contact with the fire. The oxygen enters into union with the carbon, of which all fuel is largely composed, and the other constituents, forming new compounds and evolving light and heat. Like oxygen and hydrogen, nitrogen is a gas without colour, taste or smell, all are soluble in water.

The atmosphere, like water is never absolutely pure. In addition to oxygen and nitrogen there are always other substances present in larger or smaller quantities. The most important of these is carbonic acid, sometimes called carbonic anhydride and carbonic dioxide, CO_2. also a gas without colour, taste or smell, but very heavy, so heavy, that it may be poured from one vessel into another as easily as water is poured. Carbon dioxide is being given off continually from the lungs of all animals ; and wherever there is flame, it is also given off as a produce of combustion. The proportion of this gas present in the air is about four volumes in 10,000. This amount, however, is not always constant. It increases during the night ; and it is greater during dry winds and fogs, as high a quantity as eight or nine volumes in 10,000 have frequently been noticed on foggy days. Country air contains less than town air ; and sea air less than that over land. CO_2, carbonic dioxide is being constantly sent into the air by the combustion of organic matter, and the oxidation of the waste tissues of animals. Unless then, some other influence were at work, the oxygen of the air would gradually diminish and the carbonic dioxide increase. This influence exists in the power possessed by plants to decompose CO_2, carbonic dioxide, retaining the carbon, and setting free the oxygen. The oxygen serves as a carrier of one of the waste products of the tissues of animals (carbon) to plants, which again return it (the oxygen), to the air and assimilates the carbon to form fresh food for animals. A square metre of leaf surface will decompose in sun-light more than a litre of carbonic dioxide in an hour. There are other sources of this gas besides those already mentioned. Carbon dioxide finds its way into the air from subterranean sources, from volcanoes, and from caves and chinks in the earth's surface. It is one of the invariable products of the decomposition of organic substances. Besides carbonic dioxide, nitric acid or some lower oxides of nitrogen are frequently perhaps invariably present in the air. The formation of nitric oxides is mainly due to electric discharges during thunder storms. In tropical climates, these are very frequent ; and very probably much of the nitric acid found in these regions in the form of potassium and sodium nitrates has its origin in a combination of the nitrogen and oxygen of the atmosphere by means of electricity. One million parts of rain water are said to contain ·0507 parts of nitric acid. In Glasgow an average number of determination gave 2·436 in one million.

Ammonia H_3N is also present in the air. A piece of clay heated to redness and exposed to the air for a few days yields a perceptible amount of ammonia when reheated. Ammonium sulphate is in like manner converted into ammonia alum by prolonged exposure to the air. The amount of ammonia has been variously estimated. The record of registers vary from 135 to ·01 of ammonia (calculated as carbonate) in one million parts of air. The direction of the wind has no influence on the amount of ammonia. The quantity decreases after heavy rain, being washed out of the air into the soil, and thus supplying plants with an important food material. A few hours after rain, the normal amount is found, being about six parts in one million. The proportion of ammonia in rain is as various as that contained in air. The quantity is greatest in the rain that falls first :—

Rain water of		Liverpool	contains	5·38	parts.
„	„	„ London	„	3·45	„
„	„	„ Manchester	„	6·47	„
„	„	„ Glasgow	„	9·10	„
„	„	„ Paris	„	3·49	„

It is contained in the water of dews and fogs in much larger quantities than in rain water.

These amounts of ammonia and nitric acid may appear trifling small, but they are large enough to play a most important part in vegetation. They are the chief source whence plants obtain the nitrogen necessary for the formation of their seeds and other parts of their structures into which nitrogen enters as a necessary constituent. Plants do not appear to possess the power of directly assimilating the free nitrogen of the air. Indeed, if placed in an atmosphere and a soil free from ammonia and nitric acid, and from substances that produce these, plants will die. Schonbein was, we believe, the first to observe that ammonium nitrate is produced by the evaporation of pure water in air. Water is constantly evaporated from plants and from the soil and it is highly probable that in this way plants may obtain and prepare for themselves a portion of their nitrogenous food. So far as at present known, the only necessary and essential constituents of the atmosphere, are oxygen, nitrogen, carbon-dioxide, aqueous vapour, ozone, ammonia and nitric or nitrious acids. The chief function of ozone, (which indeed is but nascent oxygen, oxygen newly liberated from some of its compounds and on that account capable of effecting new combinations with greater energy and activity) is to oxidize and render innocuous the putrifying organic matter which is being constantly sent out into the air from numerous sources. No ozone can be detected in large cities, nor in the air of dwelling houses. It is not found in air over marshes or in places infected by malaria, and malarious fevers are no doubt due to the fact that the air is entirely destitute of ozone and is charged with carbon dioxide, watery vapour, ammonia, and the other products of organic decay ; and is thus quite unable to carry off from the body the effete matters cast off in the process of circulation and the action of the sweat and other glands. The waste tissue remains in the system and produces disease. The depressing effect of the air of cities and large towns is very closely related to the presence or absence of ozone and its action on organic matter.

An analysis of 10,000 volumes of pure air would give the following results :—

Oxygen	equal to	20,65·94	In 10,000 parts.
Nitrogen	„	77,90·60	
Carbon dioxide	„	3 36	
Ozone	„	·015	
Aqueous vapour	„	140·	
Ammonia	„	·08	
Nitric acid	„	·005	

The atmosphere is indeed the common sewer of the world it has poured into it night and day innumerable gaseous and volatile impurities, organic and inorganic, which the forces of Nature and the ingenuity and filth of man and modern civilisation have given rise to. The examination of rain water affords the best text we at present have, for determining the amount of impurities in the air. Rain falling through air over the sea contains, chiefly common salt and sulphates. The sulphates increase inland, and are undoubtedly the products of decomposition, the sulphurated hydrogen evolved in the putrefaction of organic compounds being oxidized in the atmosphere. When rain contains more than forty per cent. of free acids, the vegetation of the district is rapidly effected. Ammonical salts increase in the neighbourhood of towns, they are derived partly from the coal used as fuel, and partly from the decomposition of albumenoid substances. It should however be borne in mind that the bulkiest factors in pure air and pure water are nitrogen, hydrogen and

oxygen, the latter being found in both. The other substances, though comparatively small, are some of them essentially necessary for the health and growth of plants.

Rain is in reality distilled water, raised by the sun's heat, in the form of vapour, from oceans, seas, lakes and rivers, and condensed by cold currents of air, mountain ranges, and table lands. Rain in its passage through the air and the clouds as float in the higher regions of the atmosphere, sweep the whole air-ocean, like a fine net and drag to earth every compound and impurity soluble in water. In seeking its level water does not only act mechanically on the rocks over which it passes; it is perhaps the most universal solvent in Nature and charges itself with whatever substances it comes in contact which may be soluble in water.

The solubility of gases in matter is a well-known fact and it plays a most important part in the economy of plants and animals which inhabit water. Sea-water contains as much as from 2,000 to 2,800 grains of solubles in a gallon. The Red Sea contains from 11,000, to 21,000 grains of soluble matter to a gallon. The following are the chief *inorganic* matters found in natural waters. Lime, magnesia common salt, sulphates, silica, iron, iodine, nitrates, sulphurous hydrogen and carbon dioxide. Lime exists in water chiefly in form of sulphate or carbonate.

COMPARATIVE PURITY OF NATURAL WATERS :—

The Clyde	contains	8	grains of	solid matter	per gallon.
„ Thames	„	20	„	„	„
„ Dee (Aberdeen)	„	4	„	„	„
„ Seine (Paris)		30 to 40	„	„	„
„ Old City Wells (Glasgow)		30 to 100	„	„	„
„ Loch Katrine	„	2	„	„	„
„ Lake Loka (Norway) ...		½	„	„	„
„ Edinburgh	...	7 to 14	„	„	„
„ Surrey (through greensand)		5	„	„	„
„ Durham		15½	„	„	„
„ Jordan		73	„	„	„

EMPIRIC FARMING.

LIEBIG, in his "Letters on Agriculture" has said, that the empiric farmer is a "mere trader in meat and corn." The word empiric, like many another in the English language has fallen from its first high estate. Its early meaning was an experimentalist, a searcher after facts in nature. Gradually it fell away from this meaning, and now-a-days an empiric is one who has given up all theoretic study of a subject, and guides himself by tradition and his own experience. In medicine, an empiric is a person, who for want of theoretic knowledge prescribes remedies by guess, without concerning himself about the symptoms of the disease, the constitution of the patient, or any other of the thousand and one modifying circumstances affecting the case. An empiric farmer then, is a man whose agricultural operations are guided solely by rule of thumb. He does, as his father did before him, as his neighbours have done around him, for no other reason, than just that they have done so and been content with their results. He does not keep himself abreast of the age; and only adopts improvements, after every one else has tested and long enjoyed their benefits. He does not trouble himself about collateral matters, he seeks simply to get from his soil the largest possible crops; and he believes *that* system the best which will give the richest harvest, at the least expense, and in the shortest time. His fathers never troubled themselves about what would become of the soil, nor what effect their system of cvltivation might have in bringing about the failure and ruin of special crops, why should he concern himself about matters such as these? If he can succeed in making a comfortable living out of his land, clear his rent, his interest on capital, and a percentage for his own labour and risk of capital; then in these results he has a proof, conclusive enough to him at least, of the wisdom and soundness of his system. When he finds a falling off in any of his crops, he tries whether growing other varities will not answer better, and gives all sorts of curious reasons why the soil has diminished in fertility. Its because the wood has been cut down, or the railway (narrow guage) has passed near his land—its the growth of the neighbouring town "as does it," its the thunders storms, of last year, its the land-tax, and the Famine Commission!

If insects attack a crop and threaten its destruction, he will believe everything and anything; but it requires little short of a surgical operation to get the fact into his head, that it is his own ignorant wasteful parsimonious treatment of the soil that is at bottom the cause of many of his ills. He never attributes this falling off to his methods of culture. In fact the idea that he himself may be in fault never occurs to him. He is, as Liebig calls him, a trader, merely, he knows indigo, tobacco or tea when he sees it; but he has no hold whatever on the principles underlying the growth, nutrition and economic production of the very commodities he trades in. He is not even grateful to the chemist or scientific man who puts into his hands a mineral or a bone soluble phosphate, who furnishes him with the principle that enables him to produce crops under conditions that will not violate and defy the very laws of their production. It may be, he tosses his phosphates on the soil without knowing more of their *composition* and effects than his own coolies or cow-boys; and thinks what a clever fellow he is when he applies nitrates, and uses appliances and methods which the scientific man whom he sneers at, has put into his hands and taught him how to use.

He is no agriculturist, but a mere fumbler and a stirer of the soil, if he has never enquired whether the system he follows is in accordance with well established truths and natural laws, or is in any way opposed to them. The rational agriculturist should never lose sight of the fact that his efforts should be directed not to the present production of the largest crops, but to an indefinate recurrence of such crops, as long as the soil and the crops receive rational treatment. The land of central Germany, the grass lands of Cheshire, and the soil of southern America, were all of them treated in such a way by their ignorant and rapacious owners, that every available particle of plant food was drained out of them, and the crop would scarcely grow seed enough for next year's sowing, much less pay for the labour of working it. Tons weight of mineral matter cannot year by year be removed from land in crops, without diminishing and at last exhausting the active, soluble substances, without which no paying crop can ever be grown. If immense quantities of plant food are removed from the land by successive harvests without any attempt to replace the loss by the natural means of fallowing and thus allowing time for the various agencies of disintegration, decay and the action of the various forces which render the dormant substances of the *soil active, that is* change the insoluble into the soluble, or by the substitution of a crop which requires mineral matter of a different kind to that of the preceding crop, if there be neither fallowing, rotation, nor manuring, then there is nothing for it but a speedy looking for of failure and disaster, as the worm turns on the foot that crushes it, so certain plants for a time will bear the most brutally gnorant treatment, expending their whole vitality in reproducing their kind, in seed bearing, till at last Nature revolts and turns on her destroyer, the crops falls and the tormentor is punished. These are elementary truths but they lie at the root, of most failures of crops and blights and insect pests and other ills that vegetable life is heir to, and need to be reiterated and repeated like the commonplaces of morality and honest dealing.

THE GRASS LANDS OF THE NEILGHERRIES.

THE future of the Neilgherries, especially the grass lands, depend on the intelligence and pains with which all the details of cultivation are carried out. The climate is excellent, and tea and cinchona promise good results, if the proper means are observed. Much of the grass land, on the plateau, contains plant-food for many years without manuring, *if lime is* judiciously applied. Rich forest lands may in some measure defy the efforts of the planter to produce failure, but if he opens up the grass lands in question in a slovenly unscientific manner, the proprietor's patience will be taxed as he waits year after year for his overdue produce. Let any man of ordinary intelligence run through the several tea and cinchona gardens on the Neilgherries, and he cannot fail to gather in what I mean. In well-selected parts he will find eighteen to thirty inches of vegetable mould on the surface, evidently the decay of vegetation for ages. This humus unlike that generally found in sholas and forests has been, by exposure to alternate rains and sunshine, beaten

down and baked into so compact a mass that rain and air cannot penetrate so long as the soil is left unworked, or is worked without judgment. The baking of the surface by the sun's rays has been augmented by the annual burning of the long indigenous grass, by the Todas from time immemorial, so as to insure a successive growth of tender shoots for their buffaloes. The vegetable mould is friable and free from clay, but yet so compact and bound together by myriads of interlacing grass roots that no tea plant has a ghost of a chance until the soil has been thoroughly broken up and exposed to the weather. I know one or two plantations where the planter seems to have called upon Nature to do almost everything. The result is stunted growth with evils innumerable, which no after effort can counterbalance. Some estates are prosperous enough, but others are monuments of shame to those who had the opening and management of them. I remember the same sort of thing in Ceylon, so far back as 1848, where soil and climate were hopelessly beaten by careless and slovenly cultivation. The grass lands of the Neilgherries, if properly treated, are richer in plant-food than one-half the forest lands of Ceylon. In a block of 1,000 acres as in Ceylon, there may be 25 per cent., that no judicious planter would cultivate with tea or cinchona. He would fill in such portion with some of the Australian guano, accacias, or wattles, not the silver, but the golden or black, the bark of which have a commercial value. The man who selects bad land because it is cheap, or for any other reason, flies in the face of difficulties, but the man who refuses to buy 1,000 acres because only 750 are worth planting is not necessarily judicious. A golden rule is to skip all patches of land, that, at a glance, are not worth a generous outlay. Never run the risk of taxing a good acre of tea with the up-keep of a bad one. This is a rock on which many a planter has wrecked himself. The buyer of grass land has one advantage over the buyer of forest. Observation, during a week in the windy season, will reveal whether the wind cuts the estate, and where. No amount of observation will reveal this correctly on forest land until the timber is felled. If grass land is found to be raked by eddies and blasts of wind from all quarters, the would-be purchaser will be wise if he leaves it alone, but after forest is bought and opened it is not so easy to do this. I prefer land, over which the wind sweeps in one direction. Ridges may be planted out with gums, and form effective break winds for the whole estate, warming the atmosphere and fostering vegetation.

Years of observation convince me that planters, as a rule, have been making a grand mistake in treating rain as "an enemy," instead of "a generous friend," to be got rid of at any price and in the most expeditious way. Weedy estates, weeded by the *mamotie* was one cause which forced this upon planters. As soon as the monsoon rains set in, they saw the loosened surface soil carried away by the rainfall into the gullies, and away to the low country, exposing the roots of the coffee or tea trees. Then came the remedy, drains and cross drains at various distances, and at various gradients. If the gradient was steep the remedy was as bad as the disease; and if the gradient was slight the drains choked. On the grass lands of the Neilgherries, I look upon the retention of the rainfall as a cheap and valuable fertiliser. To cinchona it is silver, to tea it is gold.

What does the rainfall do? I answer, only a minimum of good if the planter runs it off his land as soon as it falls. Luckily for himself he cannot prevent the plant from taking in some of its benefits as it moistens the foliage and the surface roots. I have seen the monsoon rains fall on estates, the surface of which were as hard as a pie crust, and as rain from a duck's back so did the water rush off the slopes and hills. On the other hand I have seen such rains carry off the loosened soil in tons, taking the easiest channels, and leaving little or no benefit to the estate. My anxiety is to induce the soil to retain every drop of this rainfall. I shall not succeed, but I intend to do all I can towards that end. The sub-soil, insures permeation, and I look for most favourable results.

Firstly. The rain will carry with it, not only to the surface roots, but to the roots below, even to and beyond the extreme end of the tap roots, the fertilizing substances met with and brought down with it from the air, such as ammonia, nitric acid and saline matters.

Secondly. It will soften, dissolve, and distribute the plant food it finds in the soil itself, and allow all the roots of each plant to absorb it.

Thirdly. It will, especially when alternating with sunshine, warm the under soil, stimulate the growth of the plant, and in years to come keep up a succession of flushes after every shower. The sun's power cannot effect the temperature far below the surface, but, with the soil judiciously prepared to receive the rain, every shower will carry down with it, to the roots of the plants, the warmth from the surface and so equalize the temperature.

Fourthly. In cases where the subsoil holds an abundance of iron or other noxious matter, the rainfall will serve to carry these further down and out of the reach of the plants.

We may now consider how the rainfall can be kept on the ground and be induced to enter the soil. In doing so, we must not lose sight of the maximum of benefit at the minimum of cost. Three method's present themselves to me.

Firstly. Supposing the width of the rows to be 4 feet apart, run *level* terraces 4 feet wide round the hills and slopes, and insist on their being level. Then trench 18 inches by 12 down the middle of each terrace, such terraces having a gentle slope towards the centre. The cost may be lessened by holing instead of trenching if the tea is planted three feet apart or upwards. Terracing, on average slopes, would cost about Rs. 35 per acre, and the trenching in the terraces another Rs. 50, giving 3,630 lineal yards to the acre. Holing 18 inch square pits would cost Rs. 13½ per 1,000. But let no one act upon the idea that the tea plants may be dibbled in. The soil in the Neilgherries will resent any such off-hand treatment.

Secondly.—Abstain from terracing and open up level trenches as above directed filling in only to the level of the lower side, which should be 18 inches deep, and the result will be a trench 18 inches deep, with a terrace 12 inches wide, every 3 feet. This should not cost more than Rs. 60 per acre.

Thirdly.—Hole on the level as in trenching, not up and down the hill as is usual, say 18 inches square holes at any distance required, say every 3 feet, then from hole to hole cut an 18 inches terrace sloping it in towards the face of the hill. The holing would cost as above stated and such terracing 12 annas per 100 yards, that *is*, if 4 feet rows be observed, 3,630 yards per acre, less one half already cut by holing 18 inches out of every 3 feet, say 1,815 yards at a cost of Rs. 13-9-9.

The first method is the most thorough, and the question turns upon the expense. The second method is efficient, and when tea plants are planted 2 feet apart, requiring 5,445 holes per acre, it is a cheaper than the third method. But when distances are increased to 4 by 3 and upwards, then the third method rapidly gains advantage, in the matter of cost. I should plant cinchona, the condeminia, 5 by 4 on the third method, say 2,178 holes at Rs. 13½ per 1,000 equal to Rs. 28-12-6 plus the terracing between Rs. 13-9-9 total Rs. 42-6-3 per acre.

Whichever method is chosen, the work should be done immediatly after the S.-W. monsoon, so that the soil may remain exposed until May, when the filling in must be done for June planting.

Many a planter will be horrified at not having regular lines of trees so as to facilitate weeding contracts, as terracing on a level round hills and slopes must necessitate short lives. But as I advocate cinchona belts all over a tea estate, cutting it up into 10, 15 or 20 acre plots, the weeding may be contracted for by the plot. The atmosphere in a tea estate should be kept warm and forcing, and I think close belts of cinchonas would effect this. In the middle of such plots I would recommend that 30 to 40 feet square patches should be left for heaping the grass roots and weeds on with a sprinkling of lime or other material for future use. Peat is very generally found all over the Neilgherries. Some agricultural chemists tell us that a bushel of charred peat is equal to a cart load of farmyard manure, if so, there is an inexhaustible supply of leaf giving manure at hand.

In conclusion, let no planter wed himself to any one or two schemes, however valuable they may be. In order to command success, it is necessary to work out every detail with thought, intelligence and economy. On the Neilgherries, it seems to be the

custom to contract for work or an article, and accept from the contractor as a matter of policy, work or material 25 per cent. in value below the thing stipulated. This is a vicious practice, and should be abandoned.

I may remind those who think of planting tea or cinchona on the grass lands of the Neilgherries, that they escape the expense of felling, lopping, burning and clearing. Further they have no roots of trees to contend with in terracing and trenching, so that they can afford a liberal outlay in working the soil so as to prepare it for the plants, and secure it against wash.

EDITORIAL NOTES.

THE Italian Government two years ago offered 3,000 lire for an essay "On the genus *Citrus*," but the productions sent in held by a special commission to be undeserving of the prize. Considering that the reasons still exist for which it was thought very beneficial to encourage a complete study of the physical nature and biology of the Hesperidæ, and for which the competition was instituted, a Royal decree has been issued offering a reward of 3,000 lire to the author of the most complete and best monographic essay on the structure, the vital functions, and the diseases of the acid fruits, or species and varieties of the genus *Citrus* and kindred genera, provided that the said work, by a sufficient collection of original observations and experiments, should succeed in furnishing an important addition to the present knowledge concerning such subjects, and thereby supply a scientific criterion for the improvement of the cultivation of these acid fruits and for the cure of their diseases. The date for sending in the works competing for the said prize is fixed for the end of May 1881. Essays by Italians, or by foreigners, written in Italian, are admissable to the competition, but if written in another language they must be accompanied by an Italian translation.

THE figures for plantation coffee to the 19th are 574,000 cwts. but native is so low as 30,000. The total exceeds 600,000 cwts. so that we suppose a total for the season ending 30th September of 800,000 cwts. may be reckoned on. There are large figures for baled cinnamon, 696,000lbs. but there is a great falling off in chips. Cocoanut oil is very considerably above the average, the export being 111,679 cwts.; ebony is up to nearly2 1,000 tons; and cinchona bark now counts 101,169lbs. The railway traffic to 6th April shews 46,742 tons of coffee against only 35,005 in corresponding period of 1878; but there is a falling off in both rice and manures—It is not to be concealed that the general feeling in Ceylon is one of depression and anxiety. But there are many elements of hopefulness in our position, and a real beginning with railway extension would contribute much to the restoration of cheerfulness and activity.—*Ceylon Observer.*

FOR the safety of many towns and villages, the raising of mountains to counteract torrents has become a necessity in certain parts of France. The idea appears to be exploded that the felling of forests has no influence on inundations. Planting trees according to climate and altitude, and inducing grass to grow, are the measures adopted by the French Government. The aim is, to anticipate the promotion of destructive torrents by consolidating the soil, and suppressing the effects of torrents by drying them up. It is not intended to actually abolish the torrent but to cause it to pass into the volume of a stream, to prevent its carrying down earthy matters, and producing sudden floods. By protecting the soil against the mechanical effects of rain, by regularising the currents, by dividing them, inundations can be avoided. For the temperate zones of mountains, the trees to be selected can afford no difficulty, but for Alpine regions only spruce, larch, and fir can be chosen—and larch above all, as it admirably resists atmospheric influences, requires no support adapts itself to all soils, and has the faculty of throwing out new branches from old bark. Except in elevated regions, it is an open question whether the plan of sowing or planting ought to be preferred. In any case when the latter is adopted, the trees cannot be too young.

MR. E. C. RYALL, in his report gives a good deal of information about the trade carried by Bhotias and Bashahris between Tibet and India. First in quality amongst the imports into India comes gold dust from the mines of Gartok and elsewhere in Tibet; but this item may be almost set aside, for most of the gold goes to Lassa, and very little finds its way southwards over the Himalayas. The importation of shawlwool, *pashm*, is declining; the demand at Delhi and Rampore being now much less than in former days. Large quantities, however, are still taken to Amritsar, Ludhiana, and Nurpur. The Bhotia traders say that if they could only find sufficient sale for *pashm* in the North-West Provinces, they would care less about the decline of the borax. trade, indeed would give up carrying borax altogether. The finest Tibetan *pashm* is grown in the neighbourhood of Lake Mansarowar, and the bulk of it is taken to Gartok, where Cashmeree merchants from Ladakh buy it up for the Cashmere manufactories. Large quantities of tea from Lassa are taken to the Central Asian markets, Ladakh, and Cashmere, but very little is brought to India. Some comes to Amritsar and is consumed by the Cashmerees living there; some is bought by the Bhotias who prefer it to the Indian varieties. Tea in Tibet is a Government monopoly. Eight kinds are sold in Gartock, all coming originally from a place called Darchando in China. The price ranges from Re. 1 to Rs. 8 a pound. There are strict rules against the import and sale of Indian tea; still, however, the Bhotias carry small quantities which they manage to sell to the poorer class of nomads. Besides the prohibition, the prejudices of the people are against the consumption of Indian teas: all Asiatics, and a good many Europeans, much perferring the China teas. Horses are brought, by the Bhotias and Bashahris, from Tibet to the Indian hill stations; those from Chumurti being the finest. Of shawl-wool goats, some three or four thousand yearly are brought from Tibet, and mostly sold to Hindus for sacrifice, fetching a rupee or two each. The quantity of sheep brought would be greatly diminished were there a larger demand for wool in the North-West Provinces. Salt and borax are found abundantly in the neighbourhood of the Thok Jalung gold fields. These articles are taken into Hundes and thence sold or bartered for grain by the Bhotias. Of imports from India into Hundes and other parts of the Tibet, there are food-grains, chiefly wheat, barley, and rice; raw sugar and spices: broadcloths, cotton goods, indigo and precious stones. Broadcloth, worth in the Delhi market Rs. 1-4 to Rs. 4-8, meets with a ready sale at Lassa, as also all kinds of cotton goods. *Ghara*, the coarsest kind is used for making flags, which are set up over tombs, monasteries and hill-tops, to scare away ghosts and demons. For indigo there is a lively demand in the markets of Shigatse and Lassa. Precious stones, such as turquoises, a few rubies, and sometimes emeralds, with corals and pearls are carried into Tibet; corals and pearls being especially affected by Tibetan women. The silver coinage of British India is much used too for purposes of ornament; but the supply is not equal to the demand, the Bhotias finding it pay better to give grain in exchange for their Tibetian purchases.—*Himalaya Chronicle.*

G. P. B." writes to the *Pall Mall Gazette*:—In these days of trade depression and high cost of provisions of all kinds I wish that the attention of the poorer classes could b directed to the eligibility of dates as an article of food at onc cheap and nutritious. Dates are extensively consumed by th lower orders in Egypt, as also by the Arabs in the Persian Gul and on the Shattu-'I-' Arab beyond al-Basrah, with whom date and bread form their principal diet. Those in better circumstance cook them in different ways, such as frying them with a littl *ghee*, or made into an omelette with eggs; and I can myself vouc for the savouriness of such dishes. Formerly, the only date imported into the London market were those from Egypt, calle Tafilat, which were and are still sold by grocers at from 8*d.* to 10*d* per pound. But the Tafilat, albeit a large and fine-looking *fruit* have a tough skin, and are far less succulent and nutritious tha those now brought from al-Basrah and the Persian Gulf. Thes latter are disposed of wholesale in boxes or straw sacks, at fro 10*s.* to 14*s.* per cwt. and hawked about the street for fro 2*d.* to 4*d.* per pound. A more general demand for the fruit woul probably lower the retail price, and it would be a great boon the poorer classes if they could be convinced that one pound c dates, costing about three halfpence, contains as much nutrimen as half a pound of meat, and much more than the same weigl of many of the articles of food for which they pay six or ten time the price.

The utility of the common owl as a destroyer of vermin is scarcely likely to be called in question at the present day. A remarkable instance in point is recorded by Herr Grote in the *Journal* of the Hanover Agricultural Society. Last year this gentleman discovered in his garden an owl's nest built in a hollow tree. When first observed it contained four eggs the bodies of seven field mice. On the following day six of the mice had been devoured and eight fresh ones introduced in their place. On the third day six more mice were added to the stock, and the carcasses of seven more were found in a contiguous hollow tree. Day after day the same thing was observed, a fresh supply of mice being constantly introduced. From circumstances which are not specifically mentioned, Herr Grote was only able to continue his observations for a period of fourteen days, but within this time the number of mice found in and around the nest was ascertained to be more than two hundred, and in addition to these the wing-cases of a large number of dung beetles (*Scarabœus stercorarius*) were found in the same place. In order to avoid any source of possible error in his computation, the observer took the precaution of marking each day's supply of mice when first noticed, so as to make quite sure that none of the bodies should be counted twice.—*Farmer.*

An interesting series of experiments were entered upon last season by the Superintendent of Cotton Experiments, in Scinde. These extended over cotton, bajri, sorghum saccharatum, jowri, lucerne grass, jute, rhea, prickly comfrey, ground nut and sundry other articles, but we are sorry to state that we can make almost no use of the report, kindly sent us by the obliging Assistant Secretary to the Government of India, Department of Revenue, Agriculture and Commerce, (Statistical Branch), on account of want of uniformity in the mode of conducting them, for instance, after an exhaustive report, explaining why the contiguous plots gave such diverse results from the same class of treatment, we find he following explanatory note. "I do not think that from this "one experiment it would be safe to conclude that the lime was "decidedly injurious to the crop, a good portion of the difference— "nearly 23 per cent. at least—may safely be attributed to the "natural difference in the fertility of the plots."

This system of experimenting is fatal to that authoritative conclusion which should be deducible from any well conducted experiment. Conditions at starting should be precisely similar, else the conclusions cannot be comparable. The Superintendent promises to continue them this year under a better system.

Referring to Jersey cattle the *Journal of Agriculture*, (American), says that their milk produces from 21 per cent. to 56 per cent. by weight of butter. In this country we think we do well if we get one chittack per seer, which is 6¼ per cent. Of course we know that the grasses of India may not be so nutritious as those of some of the virgin States of America, but still we think that judicious feeding might do much to improve our supply of butter. In Calcutta alone there is a large demand for it, and it is an article that people would not grudge to give a good price for, provided they got it good, we have ourselves made 3¼ chittacks of good butter from each seer of milk, this equals 20 per cent. We adopted the home plan of collecting cream, and making the butter daily from this cream, the native habit of churning the fresh milk does not produce nearly so much butter, nor is the quality so good. There is a good opening, we consider for a dairy farm in one of the suburbs of Calcutta where a good supply of water was available.

The *Gazette of India* contains a "Report on the Adminis-"tration of the Department of Agriculture and Commerce, "N.-W. P. and Oudh for 1877-8" and an exceedingly interesting document it is.

Mr. Buck having been asked by Government whether the expenditure of the Saharunpore experimental gardens could not be cut down, objected to such a saving being effected at the expense of the usefulness of the gardens and the Lieutenant-Governor upheld the plea, we think is a step in the right direction. There are some public works which pay their way, but an experimental garden or farm is surely not one of them. This is the rock at which many of these model farms have split. They have been expected to pay their own expenses.

The report is very interesting as indeed is everything with which Mr. Buck has to do, but it is more than this, it is instructive, and thoroughly practical. One portion of the report we endorse very heartily, and that is the desirability of establishing a farm somewhere for the express purpose of improving grain for seed purposes. Any one who has travelled over the length and breadth of the land must have seen incontrovertible evidence that poor soil and want of proper cultivation were not the only causes of the paucity of crops. There are various others, and among them bad seed. At home a farmer does not use seed grown on his own land, he prefers to purchase from a neighbouring country it may be, at least he likes a change. Here the same seed is used year after year and century after century on the same field most probably, and this coupled with the other drawback, to successful cultivation so much in vogue here, lead to what we see going on around us, a steady but sure decay in the quantity and quality of agricultural produce. The same remarks apply to cattle breeding, which subject is also touched on in the report under notice.

We are sorry that the Government of Madras has not seen fit to agree to Mr. Robertson's proposal of a series of small prizes, for well-managed farms. We do not refer especially to what he speaks of as the Irish system, but of any system suited to India. We think a few small local exhibitions, where such prizes were given would have more effect with the ryot than half a hundred circulars from the collector *sahib*. A couple of years ago there was an exhibition in Rajcote, Kattywar, which we believe was a great success, and who can gainsay the good that is likely to result from the meeting at Songad, also in Kattywar, under the auspices of Major Nutt or of the Bulandshahr agricultural show and horse fair.

These are the class of meetings that are wanted, not grand exhibitions, at which the humble ryot is afraid to appear, but smaller meetings where he will meet generally his own class, and where he will see for himself what others are doing. These meetings supplemented by a few small money prizes are calculated to spur the cultivators to greater exertions.

From a perusal of the report on wheat cultivation in the Punjab for 1876-7, which has just reached us through the courtesy of the Secretary to the Financial Commissioner, Punjab, we find that looking at the subject from an "average" point, the Punjab is not so far behind other countries. True she is a long way behind Great Britain in the matter of yield, but Great Britain expends a deal on high cultivation, which the people of India could not afford to do, but when we compare the outturn per acre with that of America with its comparatively virgin soil, we see how the case stands.

The average production in the Punjab per imperial acre was 800 lbs., and we find that while in America; some States produce 40 bushels, the average is not over 15 bushels of 60 lbs. equal to 900lbs. From the statistical table in the report we find the outturn per acre running from 3·36 maunds in Sirsa to 16·33 at Jullundhur. From Jullundhur we note that it costs Rs. 1-2-0 to convey this wheat to the nearest seaboard, Calcutta or Kurrachee. This charge is equal to Rs. 31-8 per ton or Rs. 6-11 per quarter, and is a very high charge for transit, although it must be borne in mind that the distance it has to be carried is not less then 1,193 miles.

This leads to the question as to whether it would not be advisable to the Railway Companies running heavy goods trains at very cheap rates, and without any particular regard to speed. We suppose a speed of ten miles an hour would suffice for such a traffic. The consumption of coals would be light and the general expenses trifling. Now that the Indus Valley and Kurrachee will be disputing the palm for the grain traffic of the Punjab, it behoves the East Indian Railway Company, to bestir itself, besides the Rajpootana line by Baroda will be making

a bid for this traffic shortly, all these ports of embarkation Calcutta, Bombay and Kurachee have their advantages, and that one will get the traffic which offers, most and greatest inducements.

EXPERIMENTAL FARM :—We have stated before in these columns that the Local Government had decided on selling this farm. The subject has formed matter of correspondence between the Commissioner of the Nundidroog Division and the Chief Commissioner, and the following is the determination arrived at by the Government :—It is obvious that before the Experimental Farm lands can be advantageously disposed of either by sale or lease, it is necessary to settle once and for all the question of the proper kodi level of the Sonakal tank; at present that level is so high that much of the farm-land is subjected to inundation. The Chief Commissioner desires therefore that the Officiating Commissioner will at once place himself in communication with the Chief Engineer, and that these officers visit the spot in company with the Deputy Commissioner of the Bangalore District and determine whether the waste weir level of the Sonakal tank cannot be lowered, sufficiently to obviate flooding the land of the Farm above it, without detriment to the cultivation carried on below, or if one or other must suffer, whether it would not be better to lower the level, and compensate the occupants of the irrigated land below for their decreased water supply. As soon as a decision is arrived at, upon this matter, the Farm should be advertized for sale *en bloc*, the date being fixed on the earliest day practicable with regard to giving due notice of and publicity to the intention to sell. In any case the date of sale cannot be later than the end of May, and if the Farm cannot be disposed of by sale by that date, the Chief Commissioner will be willing to lease it. The Farm and the buildings on the Farm will be put up in one lot, the implements will be sold separately, and an upset price representing the full value of the land should be placed upon the Farm, as the reserved price, under which it will not be sold. The land both in quality and situation is no doubt of value and will increase in value, and it should not therefore be sacrificed. In the event of the Farm being sold, the disposal of the house now occupied by the Superintendent will be next considered. The Chief Commissioner cannot accede to the offer made by the Roman Catholic Mission which the Officiating Commissioner forwards in the above letter.—*Bangalore Spectator.*

EXPERIMENTS are being carried out at Roorkee with the view of testing formulæ at present in use, and investigating the laws of the motion of water; a correct knowledge of these laws is essential to hydraulic engineering, and especially in the branch of that science relating to irrigation works, for on this depends the correctness or otherwise of the engineer's calculations, whether as to capacity for his channels and masonry works, or as to the amount of revenue to be derived from the use of the water.

The formulæ at present in use are based upon experiments with small volumes of water, and, though correct as far as they go, it has long been recognised that they are more or less untrustworthy when applied to the motion of large volumes of water, such as have frequently to be dealt with in practice, and that they do not fully meet the varied circumstances of slope and nature of beds of channels met with in works of this class.

The Government of India possesses in the Ganges canal and its works, more especially in the Solani aqueduct at Roorkee, opportunities of carrying out experiments of this nature such as no other Government can command, and the results of these experiments will be alike useful to this country and to the rest of the civilized world. The conduct of the experiments has been entrusted to Captain Allan J. C. Cunningham, R. E., an officer of high scientific attainments. His investigation and reports on the subject have already attracted favourable notice in European scientific circles.

The financial arrangement sanctioned to meet the cost of these hydraulic experiments, were recently reported to the Secretary of State who, in reply, has written : "The great professional and "financial importance of these experiments in respect to irrigation "in India is forcibly dwelt on in the correspondence forwarded "with your letter, and I approve of the aid your Government has "afforded from Imperial Funds for their prosecution."

MR. ROBERTSON, M. R. A. C., Superintendent of Government Farms, recently submitted for the information of the Madras Government two pamphlets received from Professor Baldwin, the head of the Agricultural Department of the Board of Education in Ireland, on the subject of improving the agricultural practice of small farmers in Ireland. Mr. Robertson remarked that the prize system in augurated by Earl Spencer, K.G., seems to have been fully successful, and efforts are now being made to extend its operations to the whole of Ireland. "In many respects the condition of agriculture in Ireland resembles the condition of agriculture in this country, though of course the agriculture of Ireland is greatly superior. I possess a considerable personal experience of the circumstances under which agriculture is practised in Ireland, and have acted as judge of farms in connection with the North-East Association of Agriculture in that country, which began some time ago to offer prizes for well-managed farms, though its operations did not extend to such small holdings as does Earl Spencer's system. And I am of the opinion that we might in this country with advantage adopt a prize system in endeavouring to promote good farming in this country. Of course the Irish system would not be adapted in its present form for the requirements of agriculture in this country; however, the needful modifications can readily be made. It will afford me pleasure to submit definite proposals, say for one Collectorate only at present." The Board of Revenue observe that the prize system in Ireland was worked in connection with a ready-formed machinery, namely, agricultural schools and school-farms such as were proposed in the Board's Proceedings of 13th December 1877. The Government have as yet passed no orders on those Proceedings, owing apparently to doubts as to funds, but the Superintendent's letter and enclosures will now be submitted to them, with the remark that trial of the prize scheme must await the introduction of school farms. Mr. Robertson's proposal seems a practical one, and likely to lead to good results, but the Government consider it "premature."

WE understand that the Scotch Company who purchased Messrs. Nicol and Co.'s concessions in the Wynaad, have engaged the services of an experienced mining engineer, who is shortly expected to carry out the prospections, and to arrange for commencing operations on a large scale.

NOTWITHSTANDING the fall in the price of food grain in our market, as well as in the Mofussil, the British India Company's coasting steamers are steadily working in the grain traffic, every steamer from the north brings in a fair quantity of grain, and for the past month about 17,000 bags of grain, have been landed, consigned solely to native merchants in Madras. From the mofussil there is grain daily being imported, and our market just now is very fairly stocked. Local quotations on Friday for first sort country rice is $7\frac{1}{2}$ measures per rupee, and ordinary rice 8 to $8\frac{1}{2}$ measures per rupee; paddy, ragi, cholum and cumboo are sold at 15 to 16 measures per rupee.—*Madras Times.*

THE intimation Mr. A. Cooper Abbs, Attorney of the Madras High Court, and Advocate in the Mysore and Coorg Courts, gave some days ago in the *Madras Mail* that he will be under the necessity of bringing a civil action against the Coorg Government, is soon to be realised, for we learn from Madras that this gentleman and Mr. Grant, planter, Neilgherries, have jointly issued a legal notice to the Superintendent of Coorg, that within two months from the period an action will be instituted before a competent Civil Tribunal for the recovery of Rs. 3,000 odd. The facts connected with the affair appear to have been as follows :—Mr. Abbs, after seeing an official notice in the Mysore *Gazette* to the effect that certain lands were to be put up for public auction, in due course bid for the same, and bought them up. He also purchased another piece subsequently, but on a survey taking place, it was found that Piece No. I was included in Piece No. II, so that, according to Mr. Abbs, he has paid twice over for the same thing. On his applying to the Superintendent for the return of the money overpaid, it was refused, and hence the proposed suit. What are the grounds on which Government refused, of course, are not known at present, but the Revenue authorities must know what they are about.

COMMUNICATED AND SELECTED.

MR. MECHI ON THICK AND THIN SOWING.

FROM the veteran owner of Tiptree Hall we have been favoured with the following:—

I have always said that this is a question depending on soil and climate, and that each farmer should, by comparative experiments, arrive at the most satisfactory conclusion. When I first farmed here, some 35 years ago, I tried 1 bushel of wheat per imperial acre against the 2 bushels usually sown hereabout, and found that the 1 bushel gave me an advantage of 30s. per acre; so I adopted it. I did not find much difference between 4 and 5 pecks. I have grown just as much from 2 pecks, and even from 1 peck per imperial acre; but to make sure, I drill a bushel at nine inches from row to row, because I am enabled to horse-hoe on the 9 inch spaces; and a man and pair of horses can do 12 acres per day. Where I do not horse-hoe, I sow the same quantity of seed with 6 inch intervals. My usual drilling of barley is at 6 inches from row to row, and 6 pecks per imperial acre. I have grown just as much from 1 bushel. Of oats (Tartarian), I drill 8 pecks per imperial acre, at 6 inch intervals; and have frequently grown 88 bushels per imperial acre—in one instance 104 bushels. In fact, I have found even 2 bushels to be too thick, and have suffered injury by premature laying in a summer storm. I attach much importance to a standing crop, which only gets bent or partially laid when ripe. Thickly sown crops, on well-farmed land and suitable climate, get prematurely laid, and in consequence get inferior as grinding barley, and thin oats, and small-headed wheat.

In 1868 (a fine season), my wheat crop averaged 56 bushels per imperial acre—one field yielding 64 bushels. Of barley (after wheat), I frequently got 7 quarters, of malting quality.

Early laid crops shut in the damp from the earth, and thus encourage the under-growths of clover or weeds. In a fine upstanding corn crop air circulates freely, green vegetation is checked, and we get large ears and kernels, and stiff, glossy straw.

The only excuse for thick sowing is a late district. No doubt thick sowing hastens the harvest, because prematurity is earlier than maturity. Wheat, oats and barley should give a return of 40 for 1. The person who sows 12 bushels of oats per Scotch acre should therefore get 480 bushels per Scotch acre. Does he do this? If so, I should be very much astonished. I could hardly believe that any farmer wasted so much money in seed; but I am bound to believe what I read in the *North British Agriculturist*.

In our southern climate I know that very thick sowing robs many a farmer.

J. J. MECHI.

Tiptree Hall, April 14, 1879.

P. S.—In our county we use the drill for sowing; very little broadcasting is done.

J. J. M.

—*N. B. Agriculturist.*

CONTINENTAL AGRICULTURE.

IN the new law in course of being voted on popular education, the teaching of agriculture in the rural national schools will be obligtory, and will at once take effect. This is going a little too rapidly; most of the country school-masters are not prepared to impart the desired instruction; all that can be reasonably expected from them is, that they prepare themselves, as well as their pupils, by means of judiciously selected treatises on rural economy. Later when the Normal Schools are inaugurated, and masters duly trained, greater results can be demanded. Each department is to have its Normal School, to which an agricultural professor will be attached; fifty professors are required, and six years are allowed to execute the programme. The supply of suitable candidates for these chairs of agriculture is at present very limited; in time, the superior agronomical colleges will meet the demand. The new professors will be required to hold conferences for the benefit of the surrounding farmers, as well as to impart instruction in the Normal Schools, hence a special tact is necessary for attracting adult attention. In the agricultural school of Ecully, near Lyons, advantage is taken of the Rhone to teach fish culture. Many farming societies give prizes to the proprietors of oyster beds and fish ponds.

It is no secret that good horses are not on the increase in France; many departments, famous for their production of horses, have to-day no reputation. The artillery horse is the type desired: In general the horses are too light, too fine, and hence the leaning towards the omnibus horse as the ideal, which has endurance, is large, draws well, and trots. There are twenty-two official depôts of stallions in the country yet the amelioration in the breed does not produce the expected results, because no care is taken in the selection of the mares to be covered; farmers simply aim to have a foal. It is suggested that the stallions of the State be allowed, without fee, to serve only those mares selected by competent local authorities; the receipt for the service would serve later as a leaf from a herd-book, for purchasers of the progeny. The Government also could undertake to select private stallions, and to indemnify owners for their services.

An old Alsatian agriculturist, as the results of his experience in the standing dispute as to the milking qualities of the Durhams, states he has only pure Durhams in his sheds, that yield their average 14 quarts of milk daily; that the secret to make Durhams good milkers, is not to "fatten" the stock during the first years of their existence, nor yet insufficiently feed them; for it is during the first year of the animal's growth, that a pound of flesh costs least to produce. Taking food as the base of calculation, he finds no breed pays relatively better for their keep than Durhams, and they consume from a fifth to a fourth less rations than Dutch or Swiss cows.

Leibig was the first to raise his voice against the exhaustion of the soil caused by the cultivation of beet for sugar. He showed that all the alkalies contained in the roots were concentrated in the molasses, hence, the "fatigue," or exhaustion of the soil within a short period. Potash is absolutely necessary in the functions of the plant to produce sugar, and even when returned directly to the soil, it fails to restore the latter's vitality for beet cultivation. This apparent anomaly is due to the fact that the organic matters of the surface soil rapidly seize and retain the salt, while beet, being a tap rooted plant, draws its food from the depths of the soil where the sustenance is limited, and so becomes insufficient after a few crops of beet. This is the explanation of many, why the soil of Saxony and of other regions now fails to produce sugar beet. Soils repel the plant, which about July commences to fade, sinks into decrepitude, and rots—the leaves last. If a vertical section of the root be now made, the tissue will be found covered with red rings, the first indication of decomposition. These roots yield little sugar, and the pulp will not preserve in trenches; even when sound, the sick roots communicate contagion to a whole pit. The soil occasionally displays signs of weariness one season, recovers another, but relapses into more intense fatigue afterwards. In addition to the explanation of exhaustion, Messrs. Liebscher and Marker of Halle, have discovered the presence of a parasite called *nematode*, which is as numerous, and propagates as rapidly, as the phylloxera itself; they are to be encountered on the rootlets in the form of white specks; rarely on a diseased plant, for having destroyed the latter's feeders, they decamp. These insects are never found in large numbers where the beet thrives well; they are more frequent in a soil where the beet is raised for seed; and it is essential never to employ the washings and root-trimmings of the sugar factory, if the beet delivered appears to be affected. It is not clear if the presence of the *nematode* be the cause or the consequence of the disease; it is a diagnosis of the malady, and may resemble the animal economy, where parasites prey on bodies insufficiently nourished.

The relative value of beet pulp is important. The sugar or juice is extracted in two ways; by rasping the root and pressing the pulp, or by cutting the root in thin slices, and steeping them in warm water. The first plan breaks up the cell, and pressure mechanically forces out the contents; the slicing keeps the cells more or less intact, and the warm water exhausts their contents by the law of diffusion. The second method is common in Germany and Austria, and is spreading to Holland and Belgium; but farmers dislike the pulp, as it contains 94 per cent. of water; it is inconvenient for carriage and objectionable for feeding purposes as too aqueous a dietary necessitates a useless expenditure of animal heat to raise the water to the temperature of the economy; further, too diluted food augments the decomposition of the albumen in circulation. However, by employing the Kluseman press the percentage of water can be largely reduced, with not a greater loss than 3 per cent. of dry matter; in this condition it will conserve well in pits, and retain its superiority of richness in albuminous substances. Unpressed, according to Dr. Petermann of Belgium, the slices are commercially only half the value of the rasped pulp; reduced to a like degree of humidity, the sliced is richer than the grated pulp for feeding purposes. M. Barval has analysed some English beet roots, the Mammoth variety, weighing 30lbs. a root; he found them to be so rich in nitrate as to be positively dangerous for alimentary, as they are totally unfit for sugar purposes. Molasses contain a portion of sugar, to separate which many processes have been tried, but all of which, while liberating and securing the five or six per cent. of pure potash, destroyed from 10 to 12 per cent. of potash salts, and two per cent. of nitrogen in the ammoniacal and organic form, during distilation. By the discoveries of Messrs. Scheibler and Seyferth, this combined potash and nitrogen can henceforth be utilised. Sugar being composed of carbon, oxygen, and hydrogen, science and mechanics ought to be able to restore all the other complimentary matters of the beet to the soil, either in pulp, scum, or washings. The beet harvest of 1878 has been better for the cultivator than the manufacturer; active operations are going on for this season's crop, which will be very extensive, as is ever the case after a bad wheat year; such as that just expired. If the farmer employs the seed given him by the factory, the beet will be taken from him at fr. 17, instead of fr. 18 the ton, the density of the juice to mark 5·2. French growers have not been yet able to realise 8 and 10 per cent. of sugar, as is done in Russia, Austria, and Germany.

Many French farmers who purchase lambs to fatten for the butcher, lose about 10 to 20 per cent. of them, when six weeks old, from the "gout"

as arthritis. This is not an uncommon ailment among young cattle and horses in Hungary, Saxony, Prussia, &c.; but for lambs, it is rather new. The disease affects the animal during the first months of their existence, and during the suckling stage only. The cause is attributed to an alteration of the mother's milk, and its deficiency in phosphates or mineral matter. The symptoms of the disease are painfulness in walking, a tendency to lie down, tumefaction of the joints, which are hot and swollen, strong fever, rapid respiration, spasmodic contractions, absence of appetite, ardent thirst, the animal endeavouring to crawl to a trough, or to suckle its mother, constipation at first, followed by diarrhœa, and terminating in dysentry, slight running at the nose, and, after a few days, death. The "remedy" is of little value, one ounce of Glauber's salts. Better see that the soil be supplied with phosphates, and when the gout appears in the sheds, give the ewes an aqueous dietary of carrots, beet, parsnips, &c., putting a little of the aforesaid salts in the drink or sprinkling it over the roots, a linseed drink with a little aloes or bicarbonate of soda thrown in is not bad. In thus treating the mothers, one prescribes for the lambs.

RAINFALL RETURN FOR COLOMBO.

(Supplied by the Surveyor-General.)

From	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
1st to 31st January ...	...	13·88	3·60	1·21	0·04	2·23	0·31	4·82	1·84	12·57	2·20
1st „ 28th February ...	...	0·51	0·70	1·19	4·30	5·18	0·09	0·90	0·20	0·14	4·09
1st „ 31st March ...	...	8·55	7·01	5·98	7·23	1·66	4·68	5·41	2·66	0·84	9·36
1st „ 30th April ...	...	8·18	8·44	10·50	6·98	8·12	19·11	16·28	4·66	4·23	13·46†
1st „ 31st May ...	...	7·87	8·64	4·37	25·94	12·34	12·22	24·77	10·80	22·09	
1st „ 30th June ...	...	8·36	6·21	2·09	6·59	4·90	15·92	5·25	3·61	19·36	
1st „ 31st July ...	...	2·73	2·61	1·34	4·41	2·95	2·94	2·90	3·32	28·04	
1st „ 31st August ...	7·87	4·57	1·38	4·09	2·07	1·16	3·30	0·15	5·63	19·54	
1st „ 30th September	5 72	4·81	1·77	8·55	1·32	1·07	3·53	1·76	21·80	6·55	
1st „ 31st October ...	4·18	36·23	7·30	2·88	11·98	10·24	9·82	19·21	10·15	16 38	
1st „ 30th November	16 61	17·05	11·16	17·27	9·56	9·10	14·46	2·01	13·46	4·37	
1st „ 31st December ...	6·67	4·84	6·27	2·57	5·2)	3·08	3·27	5·15	17·72	4·89	
Total ...	410 5*	107·53	65·09	62 07	85·62	57·03	89·57	86·51	105·84	139·70	29·20

* No records in S. G. O. before August this year. † From 1st to 24th April 1879, 13·46 inches.—*Ceylon Observer.*

THE ABSORPTIVE POWER OF SOILS.

DR AITKEN'S seventh lecture on the Chemistry of Agriculture delivered in the Highland and Agricultural Society's Hall, was on "The Absorptive Power of Soils."

Dr. Aitken demonstrated the fact that ordinary dry earth has the power of absorbing many kinds of colouring matter from solutions containing them, and that different samples of soils had very various absorptive power. This was shown to be not merely a mechanical filtration, but in most cases rather due to chemical action. The researches of Way, thirty years ago, the lecturer said, added much to our knowledge on that subject. He found that when solutions of certain salts were poured upon soil contained in a pot, the water which drained away had a very different composition—the base of the salt was retained by the soil, and exchanged for a proportionate amount of lime; thus when a weak solution of sulphate of ammonia or sulphate of potash was poured on the soil, the water which passed through contained sulphate of lime, but no ammonia or potash. This was a fact of great importance to agriculture; for experiments showed that the bases most firmly retained by soils were precisely those which plants required most for their nourishment. The soils which absorbed these best were found to be those which had been most completely weathered. The absorption of ammonia by soils had been very carefully investigated by Voelcker. He found that a certain amount of ammonia was absorbed by all soils, and that though water was able to wash out a considerable amount of it, yet it could not take it all; and this was very important information to farmers, as it assured them that ammonia applied to the soil would be retained by it during ordinary seasons, and that even during very wet seasons it could not all be lost. The special constituents of the soil which favoured its absorptive power were only imperfectly known. Silicates of alumina and iron, weakly combined with other bases, were thought by some to be especially favourable. Organic matter, also, was known to have a great power to absorb ammonia; but owing to the exceeding complexity of soils, and the great variety of chemical combinations and decompositions capable of going on in them, it was impossible for chemists to do more than guess at the relative importance of the various constituents of soils, as affecting their absorptive power. The solvent action of the roots of plants still further complicated the inquiry. The state of combination in which plant food existed in the soil was of the utmost importance to its fertility. Liebig advanced the theory that it was only such food as was in physical combination that availed for the nourishment of plants; but such a hypothesis was unnecessary. Substances in highly complex, but weak chemical combination in the soil, were in the best condition for being decomposed and absorbed by the solvent power of the root. What the solvent power of the root is we do not know, and have tried in vain to imitate it. Were we able to imitate the solvent action of the root, we could then determine in the laboratory the precise measure of fertility of various soils. But so far from being able to do this, the chemist is scarcely able, from his analysis of a soil, to say whether it is fertile at all. Soils known to be barren are sometimes found to contain all the elements of plant food in greater abundance than soils that produce large crops. The method of analysis employed by chemists is successive treatment with weak and strong solvents, as water and hydrochloric acid; but these bear little or no resemblance to the action of the root. Soils treated with strong acid have been found still to yield nourishment to plants. H. Von Liebig tried weak acetic acid; Grandeau recommends dilute ammonia; others carbonic acid and water; but all these were merely empirical efforts to gain some kind of indication of fertility, whose success or otherwise depended on the accidental character of the soil. Knop had made a valuable research with the view of discovering a measure of fertility in soils, and was of opinion that the silicates of the sesquioxide formed a good criterion, no soil, he found being fertile which contained less than 3 per cent. of these.

There was one direction in which the chemist was able to give valuable information. He could tell the cause of barrenness when that was due to the want of some important element of plant food. No soil was fertile which had not the elements of plant food; but it might have the elements of plant food and yet be barren, or nearly so.

The lecturer then proceeded to describe the various conditions of the soil most favourable to weathering—the effect of warmth, moisture, and organic matter. The dark colour of a soil favoured its absorption of heat; the lighter the colour the more heat was reflected and the less absorbed. Dark soils, therefore, weathered quicker, and caused the crops to germinate and ripen more rapidly than light-coloured soils; and this was a matter which the farmer had to some extent within his own control; for the application of soot on the one hand, or calcareous shells on the other, tended to darken or lighten the colour of the soil, and so to hasten or retard the ripening of the crop.—*The Country Gentleman's Magazine.*

A REMARKABLE PARASITE.

THE life, history, and the agamic multiplication of the aphididæ have always excited the interest of entomologists, and have even attracted the attention of some of the most eminent of our naturalists. To every amateur gardener—nay, to every grower of a geranium or a rose bush, these destructive pests are known; the now notorious grape-vine phylloxera belongs to the family. With all their vast numbers and their universality, their life history has baffled the skill of many an observer, and this has been especially the case in the gall-making forms which so disfigure our trees. Researches carried on into the life of the phylloxera have, however, somewhat cleared the way, and Dr. Riley begins Vol. 5, for 1879 of the "Bulletin of the United States Geological Survey" with some biological notes, in which he recounts the following most remarkable history:—It will be remembered that destructive as these insects are, they are most fragile, and languish in confinement, so to trace out all their daily history for a space of over ten months was a labour requiring diligence and perseverance—one that probably would not have been successful had not Dr. Riley been helped by an enthusiastic lady friend. The first species studied is known as *Schizoneura Americana.* It infests the leaves of the America elm, sometimes in such numbers as to cause all the leaves to fall. If during the winter the cracks in the bark of an American elm that was badly infested with this leaf-curling species the previous summer be examined there *will pretty surely* be found here and there a small dull yellow-coloured egg about 5mm, long, probably still covered with the remains of the female's body quite dried up. Out from this egg will in the early spring be hatched the little crawling creature which constitutes the first generation in a very remarkable series, settling upon the tender opening leaves. This "stemmother" begins to feed, causing the leaf to swell up and pucker until it at last curls over the tiny form. After three moults and the temperature being warm, it commences to people the leaf with young, at the rate of about one every six or seven hours. The second generation, though they never grow to be at all as large as the stem-mother, are like her in many respects. They accumulate in vast numbers, some of which, scattering, form new colonies. Their issue forms the third generation, which are destined to become winged. These winged forms are short-lived, but they lay 12 or fens pseudova at average intervals of about half an hour. The young

plant-lice from these form the fourth generation, the members of which are very active, running swiftly. They are of a brown colour, and are somewhat like in general appearance of those of the second generation. In this stage they swarm over every portion of the tree, and their necessities cause them to migrate, in which effort masses of them get destroyed. The fifth generation is very similar to the fourth. It gives rise to forms like the fourth, but without wings. These give origin to the sixth generation. All of these acquire wings. These abound in the latter end of June, and early part of July. They congregate on the bark, seeking out sheltered cracks or crevices, in which they deposit their young. These form the seventh generation, and are sluggish, of the colour of the bark, the females a little larger than the males. They have no mouth. They live for several days without motion. The female seems to increase in size by the enlargement of her one single egg. Both sexes soon perish, leaving among their shrivelled bodies the shining, brownish, winter egg, with which we started; so, after a long series of vegetative reproductions, at last the time comes for the renewing of the race by this zygospore-like body. Surely in this lies a hint to our plant growers. It would be easier to destroy a single egg than stop a stream of agamic-produced forms extending to six generations.—*Glasgow Mail.*

THE ELECTRIC LIGHT.

EXPERIMENTS AT THE ORWELL WORKS.

SOME interesting experiments with the electric light were made at the Orwell Works. The success achieved by Messrs. Ransomes, Sims, and Head, with their patent governor for securing regularity in the running of engines for generating electricity has gained them a wide reputation, and they are just now executing an order for four engines and machines combined for the Indian Electric Light Company for use in India. For electric lighting one of the greatest difficulties to contend against was the necessity for regularity in speed, and to secure this Messrs. Ransomes adapted their patent automatic governor expansion gear, which regulates the movement of the engine to such a nicety that the revolutions remain without any perceptible fluctuation. In all the experiments which have been made it was found better to employ separate steam engines, than to use any engine which might be at work in the factory or place requiring to be lighted, and this has induced the Messrs. Ransomes to turn their attention to the adaptation of their portable engines for electric purposes. They have met with success in the undertaking, and have adapted four 6-horse power engines for the Indian Company. The electric apparatus is carried on a platform extending beyond the smoke-box of the engine, so that the whole of the machinery, motive power, and electric generating and distributing, is self-contained, and the engines being portable, they are readily transported from place to place. The Gramme machines are employed, and as there are two to drive—one exciter and one divider and alternator—the engine is fitted with two large fly-wheels, one for each machine. The Jablockoff candles, which are used with the Gramme machines, consist of two points of carbon placed in a parallel position, with a thickness of non-conducting material between. As the positive point always burns more rapidly than the negative, the alternating machine was introduced, so as to throw the current backwards and forwards from point to point several thousand times per minute, and in this manner keep the carbons perfectly level. Each candle is equal to about 600 sperm candles, and six lights can be kept burning by one engine. To produce the light, the exciter machines makes 1,200 revolutions per minute, and the divider 1,100. The arrangement for carrying the electric machines was designed by Messrs. Ransomes, and the plan adopted is simple and effectual. The platform rests upon an arch of iron, firmly fixed to the engine; and to secure perfect tension of the driving strap, the machines are placed upon a sliding table, worked by means of a screw, which enables the man in charge to regulate them to the most exact nicety. This aparatus is constructed from the designs of M. Dolfus, engineer to the Indian Electric Light Company, who personally conducted the experiments. At the trial the painting shop at the Orwell Works was light by six of the Jablockoff candles, and was never lighter during the brightest summer day. The building is 126ft. long by 24ft. wide, and is ordinarily lighted by 18 gas jets from the roof, which it is needless to say were quite eclipsed by the brilliant and steady light produced by the engine. Though six candles were used three would be amply sufficient for lighting such a space. We should add that the engines in question have been constructed with fire boxes of extra large dimension so as to burn every description of wood and the inferior fuel commonly found in the east. This marks a further stride towards the development of the electric light, and we heartily congratulate the Messrs. Ransomes on being the means of affording an additional proof of its utility for illuminating purposes.

INDIAN PLANTS ADAPTED FOR COMMERCIAL PURPOSES.

BY JOHN R. JACKSON, A. L. S.

(Read before the Society of Arts, March 7.)

THE recent adaptation in this country of many products and remedies furnished by Indian plants has directed fresh attention to our Eastern possessions, as a source from whence we may, in time, expect to receive many new and valuable commodities. Considering the vast extent of country, and the varieties of climate that prevail over the great Indian Continent belonging to the British Crown, it is, perhaps, not a little surprising that more has not already been done to develop its resources. It is true that several noble efforts have been made to introduce and acclimatise foreign plants of acknowledged commercial value, and this extending over a number of years down to the present time; and some to these efforts have been eminently successful. It is not necessary for me to do more than merely refer to these introductions, by which you will understand me to allude primarily to the cinchonas, the Para rubber plant, and the mahogany tree. There is, no doubt, a large field still open for successful culture in India of many valuable economic plants, not only those which, like the cinchonas themselves some years back, are in great danger of being exterminated from their native homes, but many also whose wider geographical range of culture would add to the world's resources, and, by competition, produce larger supplies, at consequently cheaper rates to the consumer; and besides this consideration for the consumer at home, the larger the area of land put under profitable cultivation the better it is for the country concerned, not only on the score of increasing its revenues, but, what is of equal importance, the employment of the population in tilling the soil, or in the various arts and manufactures which proceed from a system of high cultivation, and, as a result of all this, a contented and prosperous people. It will not be denied that these are points to be aimed at in the formation of any new country, and, though India cannot be said to be a new country, either historically or in its relation to England, we, unfortunately are not in a position at the present time to say that that peace and prosperity, so desired by us all, reigns over the extent of our Eastern Empire. On the other hand, India still requires much careful consideration, not only from the diplomatist and the military tactician, but also from those skilled in the arts, manufactures, and commerce, on whose individual or united exertions much of its future prosperity depends.

It is not to the subject of the introduction or acclimatisation of foreign plants in India, of which I have incidentally spoken, that I wish to draw particular attention. There is plenty of room in the country for this kind of work to go on, and there are plenty of plants suitable for such introduction; but it must not be forgotten that India is specially rich in plants of acknowledged economic value, whether they be regarded as furnishing food, medicine, or clothing materials; but, over and above this, it possesses numberless plants, the value of which is not known out of their own country, or if known is not yet appreciated and these consequently await a further development of their uses. Then again, going still further, we may say, we shall be disappointed, if absolutely new properties are not discovered in many plants as they become more known, and by their more extended application the money value of the vegetable products of India will go on increasing. Of the extent and variety of these products at present known a good idea may, of course, be had from the fine collection in the India Museum at South Kensington, or from a glance at the extensive series brought together at the Paris Exhibition last year. This most valuable collection, which included woods, fibres, gums, resins, drugs, &c., was got together by the officers of the Forest Department under Dr. Brandis, and though the collection exhibited at Paris has found a resting place in the Forest School at Nancy, I am sure you will be glad to hear that a duplicate set has been sent to this country, and is now deposited in the museum at Kew. This collection is one essentially of forest produce, and, as such, exhibits the great importance of the Forest Department as it is managed in India; for besides the preservation and extension of valuable timber trees, which may be considered the legitimate work of forest conservancy, the production of gums, resins, and not a few drugs is necessarily associated with them. Were the work of the conservancy department confined to the preservation of trees for the sake of their timber alone, this would, indeed, be a good work, for we must not forget how rich India is in woods, valuable both for structural and cabinet purposes. Thus, for instance, next to our own European timber, oak, teak takes foremost rank, and is very widely known and used. The preservation, therefore, of the teak forests, of the sál, sandal, and other similar woods, is a matter of vital importance to the country, and it is satisfactory to know that this branch of Indian produce is now placed on such a sound and practical basis; and though there may be differences of opinion as to the means we have in England, or rather the lack of means, for the training of forest officers for India, we can but feel the necessity of a similar forest department in many other parts of the world. Included amongst forest produce, the bamboos hold a prominent place, whether we consider the endless uses to which they are put in India, or their more extended application to which so much attention has recently been drawn, namely, that for paper making. It would occupy far too much time, besides going over ground that has been traversed before, to give even the heads of the statements put forward in favour of the bamboo, or of those advanced against its practical and profitable utilisation. The opinions of Mr. Thomas Routledge on the one hand, and of Dr. King, superintendent of the Botanic-gardens, Calcutta, on the other, will no doubt be fresh in the memory of many members of the Society of Arts, having recently appeared in your own *Journal*. Those interested in the subject, I would advise, to obtain a little pamphlet recently issued by Mr. Routledge, under the title of "Bamboo and its Treatment," as well as Mr. Routledge's first pamphlet, published in 1875 by E. and F. Spon, entitled "Bamboo considered as a Paper-making Material." Whether the trade in bamboo as a paper-making material will ever develop into an acknowledged branch of commerce remains to be proved; to say the least, it seems not at all improbable, and so satisfied on the subject is Mr. Routledge, whose opinion must be taken as having some weight, on account of his great practical experience, that he says in the preface to his most recent pamphlet:—"Desiring to fully ventilate the question generally of fibrous material suitable for paper-making purposes, I have appended hereto other data bearing on this important subject which merit full consideration, not only

from a practical but commercial point of view, especially in relation to our great Indian dependencies."

In considering the suitability of Indian plants for commercial purposes I cannot hope to introduce to notice anything absolutely new. Indian botany has received the attention of some of the most prominent botanists the world has produced, notably Roxburgh, Wallich, Griffith, Wight, Hooker, and Thomson, and amongst those who have taken up Indian botany specially from a practical or economic point of view may be mentioned Royle, our honoured chairman, Birdwood, M. C. Cooke, and a host of others. The foundation of botanic gardens, and the work that has been carried on in them, together with the formation of agricultural and horticultural societies in different parts of India, have all had their influence for good, by introducing new methods of cultivation, by offering prizes for essays on the cultivation of some well-known economic plants, or for the improvement by cultivation of indigenous fruits and other produce. It cannot be denied that the existence of these societies not only has given and still gives an impetus to cultivation, but spreads a knowledge of the uses of plants among their members, and an interest to further and develop those uses, or to find new applications. Regarding the introduction into, and the distribution from, India of new plants and seeds, which is to a certain extent carried on by the societies referred to, much of course is done by the Government gardens at Calcutta, Saharunpore, Madras, Ootacamund, and Bangalore. All these gardens are centres of botanical knowledge, and are superintended by well-known and competent botanists. That the uses of botanic gardens are thoroughly understood and appreciated in India would seem to be proved from the fact, as we learn from a recent number of *Nature* of its having been proposed to establish Presidency Botanic-gardens, and a committee chosen for considering whether Poona or Bombay should be selected as the place for the principal garden of that Presidency, the decision being in favour of Ganesh Khind. "They recommend, however," continues the paragraph above referred to, "that a small branch garden, consisting of four or five acres, be established in Bombay." "The Government," we are further told, "highly approved of all the recommendations, which will be carried out whenever financial means may permit." The main scientific garden, which will embrace about forty acres, is to be laid out in the irregular picturesque style, with special reference to landscape effect, and the planting of the ground will be done gradually and without any undue haste." The chief resources of the garden, it seems, are to be devoted to the bringing together of the indigenous plants of Western India, and, until this is satisfactorily accomplished, no pains will be taken, except in special cases, to introduce foreign plants. A herbarium, botanical library, and class rooms, furnished with diagrams, are to be attached to this garden. Having said so much about the value of botanical gardens, and agricultural and horticultural societies, in diffusing an interest in plants and their consequent utilisation, I will next briefly allude to what has been done in furtherance of the same object by the aid of books. Many gentlemen here present know as well or better than I do of the extent and value of this class of literature, and I need only mention the titles of a few, such as Royle's "Productive Resources of India," "Fibrous Plants of India," Drury's "Useful Plants of India," Birdwood's "Bombay Products," Balfour's "Timber Trees of India," and last though not least, Brandis's "Forest Flora," to show that Indian products have received from time to time a great deal of careful attention; and, even down to our own day, I might further mention the labours of Dr. Cooke on the gums, resins, oleo resins, and oils, and those of Dr. Dymock on Indian drugs, which have been appearing periodically for the last two years or more in the *Pharmaceutical Journal*, to say nothing of the numerous papers to be found in the *Journal* of this Society. In view of all the illustrious names I have mentioned, besides many others that will occur to you who have quietly, perhaps for the most part with their pen and without any pomp of State, helped to make India what we see her at the present day—in view, I say, of all this, it does seem presumptuous on my part to come before you to ventilate the subject that would have been much better introduced by many gentlemen in this room, who have spent a portion of their lives in India, or, who have made India's products their special study. Of the Indian plants that appear from descriptions of their uses already given, or from the uses to which they are known to be put in their native country, I can only enumerate a comparatively few, sufficient; however, for the purpose of illustrating that the resources of India, let alone those of the world at large, are far from being exhausted. New products in the vegetable kingdom undoubtedly there are yet to be discovered; indeed, scarcely a year passes but some novelty is brought to the knowledge of the authorities at Kew, as the director's annual reports show. Speaking generally, a very great deal more might be done than is done to bring new products into use, or to develop the applications of others of which we at present know but little. Hitherto it has, unfortunately, been the fashion to condemn without a lengthened and fair trial any new product that may have come into the market, unless it bears prominently on the face of it an indication of commercial success. Naturally, the first question is will it pay? and if at the first onset from various causes it appears as if it will not pay, it is cast on one side, perhaps to crop up again at some future time more or less remote. Notices may be written and descriptions given in the various journals of our day, but unless the new product has at first some very strong claims, or some competent and energetic champion comes forward to stand by it, it more frequently sinks into oblivion. No surer or better way to prevent this, and to make the resources of any country known, is to bring the matter before the ordinary or sectional meetings of this Society; where it can be freely discussed, both in its scientific and commercial bearings; and it is with this view that I wish to point out some economic products of Indian origin that have recently been introduced into this country, and have now become recognised articles of trade, in the hope that my simple statement of facts will act as an incentive to further research into the properties of Indian plants known to be used by the natives whether for food, medicine, or manufacture. At this point I cannot but refer to what has been recently done by Mr. Thomas Christy in bringing commercial plants to the light of day, since, by a thorough investigation of all products which appear to be really useful, and introducing them to the commercial world, several have become acknowledged articles of trade between India and this country. I will now direct your attention to a few of these commercial plants from India, the most important of which is undoubtedly the *Gynocardia odorata*, or chaulmugra tree. It belongs to the natural order Bixaceæ, and is a large tree, native of Pegu, Tenasserim, and other parts of the Malayan peninsula, extending into Assam, Khasia, and Sikkim. It does not, however, reach the central or western parts. The fruit is round, somewhat like a large orange, containing numerous irregularly avoid seeds, and it is from these seeds that the oil is expressed: it has a faint unpleasant taste and smell, and, as found in the Indian bazaars, is usually very impure. Mr. Christy says, in a pamphlet recently issued by him that, "the pure oil in India is expensive, and therefore offers a great inducement to the natives to adulterate it; indeed, adulteration is carried on to such an extent, and is so difficult to detect, that it has occasionally caused medical men in India to discontinue its use. In the Mauritius it is said that so high a value is put upon its purity that the seeds are imported from India for the purpose of obtaining the oil free from adulteration. Though this oil has been long used in India and China as a remedy for skin diseases, and other complaints arising from impurity of the blood, it has only quite recently become used in this country, and now it is greatly in request for consumption, rheumatism, leprosy, and such like diseases, being given both internally and externally. It is being used in several of the London and Parisian hospitals, as well as by some of the leading members of the medical profession. Here, then, is an instance of a new commercial product from India, and one that promises to become an important medicine.

Another plant, which is official in the Indian Pharmacopœia, and which has risen to some importance, is the *Carum ajowan*, or as it is perhaps more generally known as the *Ptychotis ajowan*, an umbelliferous plant, the fruits of which are used in India as a carminative. These little fruits somewhat resemble in appearance those of the caraway, to which they are botanically allied. The flavour is, however, quite different, that of the plant under consideration having a thyme-like taste and smell. The commercial importance of these fruits as a source of thymol, a valuable antiseptic, is referred to in the *Pharmaceutical Journal* for the 22nd of February, were we are told that Messrs. Metsner and Otto, of Leipzig, alone sent out, during the months of September and October, more than a ton of this substance. The works of this firm, it is further stated, are occupied day and night in its preparation, and the demand for thymol and thymol wadding is greater than ever. This firm appears to use the fruits of *Carum ajowan* as the source of thymol, but they state that they have advices that not only has the price of the fruits advanced through a bad harvest, but also through the increased consumption of them in India by the natives during the very sickly season of last year. The *Carum ajowan* is an annual harbaceous plant, and, besides occurring wild in many parts of India, Affghanistan, Persia, Egypt, and adjacent countries, is also cultivated in the same districts for the sake of the fruits which are used in the countries just mentioned on account of their carminative and stimulant properties. Still another new drug—new, that is, to this country, but long known in India—is the rusot (*Berberis aristata*) an extract of the bark of which is now being tried in this country, having been used in India in ophthalmic cases and as a febrifuge from a very early period. The official preparation is the watery extract prepared from the root bark. As the article is quite a new one, as far as English practice is concerned, I am unable to give you any medical opinion as to its therapeutic value. *Berberis lycium* and *Berberis asiatica* both yield a similar product. Turning from drugs, our mind is directed to a peculiar product, which a casual observer would, perhaps, take for deteriorated sultana raisins. Upon closer examination, however, these prove to be the flowers of the mahwa tree (*Bassia latifolia*). This tree grows to 40 or 50 ft. high, with a trunk 6 to 7 ft. in girth, and is abundant in all parts of Central India, from Guzerat to Behar. The tree is propagated by self-sown seedlings. The following notes on this tree were read before the Linnean Society last year by Mr. Lockwood, who spent some time in an official capacity in Monghyr. He says:—

"Any one, standing on the dry metamorphic Karapoor hills in the district of Monghyr, 250 miles north-west of Calcutta, and looking into the plains below, may see a hundred thousand mahwa trees, which, if fresh from Calcutta, he will probably mistake for mango trees. But, unlike that of mango trees, which are uncertain in their yield, the mahwa crop never fails; for the part eaten is the succulent corolla, which falls in great profusion from the trees in March and April. This season is a great feasting time for the humbler members of creation. Birds, squirrels, and tree-shrews feast among the branches by day, whilst the poor villagers collect the corollas which fall on the ground on all sides. Nor does the

...ing end with the day. At sunset, peacocks and jungle fowl steal out ... the surrounding jungle to share the mahwa with deer and bears, many of which fall victims to the bullets or arrows of the hunters, who sit concealed in the branches over-head. South of the Ganges, in Monghyr, the mahwa is by far the most abundant tree. It grows on poor stony soil, ill-suited to most other trees or for the plough; and, fully appreciating its valuable properties, the native protect it wherever it grows. During the four years which I passed in Monghyr as magistrate, I visited every part of the 4,000 square miles under my charge in the cold season, paying constant attention to the natural history, particularly to the botany of the district. The mahwa tree, which I had not seen previously in Lower Bengal, attracted my especial attention; and I calculated that there must be not far short of a million trees in Monghyr alone. Each tree yields two or three hundred weight of corollas; so that the total yield of mahwa flowers cannot be far short of a hundred thousand tons in Monghyr alone. Of this amount a vast quantity goes to feed the forest birds and beasts; but of that portion which is collected by the natives by far the greater part is eaten, and supplies nourishing food to the poorer classes. The Santhals, who use it largely, are a plump and happy race, the only people I have ever seen in India who enjoy a hearty laugh, and this I attribute partly to the nourishing qualities of the mahwa, supplemented with venison and other wholesome game which the woods supply.

"During the season of scarcity which prevailed at Behar during 1873-74 the mahwa crop, which was unusually abundant, kept thousands of poor people from starving, and all famine officers will recall its peculiar odour as they passed through the villages where it had been collected. The residue of the mahwa which is not eaten is taken to the distillery, and there, with the aid of rude pot-stills, is converted into a strong-smelling spirit, which bears a strong resemblance to whisky. The Government holds a monopoly of spirit manufacture, and when I first went to Monghyr, in 1873, the custom was to charge a duty of eight shillings for every cwt. of the raw material as it entered the distillery, on the supposition that so much mahwa would only yield three gallons of proof spirit. Subsequently, in consequence of experiments made by the officers under me, this duty was somewhat raised; but in England I find that over six gallons of proof spirit can be produced from a hundred weight of mahwa. The Government of India should be made aware of this fact, and it would probably be advantageous to introduce a patent still in the place of the rude machines now in use. The amount of mahwa which nominally paid Government duty yearly in Monghyr was 1,750 tons; but with patent stills under Government control, the mahwa would probably yield a much larger revenue to the State. An Italian gentleman, who was living at Monghyr, when I was there, took out a patent for removing by a very simple process the essential oil, or whatever it is, which gives the mahwa spirit its peculiar smell; and for some time I thought he would make a rapid fortune; orders poured in on him from Calcutta, and the demand promised to be immense. But just as the inventor had taken up a whole side of the Government distillery, and got all his preparations complete, the rum distillers in Calcutta petitioned the Board of Revenue, and a prohibitive duty was imposed, which completely put an end to the manufacture of scentless mahwa spirit. A sample was sent to the chemical examiner at Calcutta, and he reported that the spirit was pure and wholesome, and came very near good foreign spirit."

Besides the uses here referred to, mahwa flowers are stated to be still more useful for feeding cattle. Pigs have been fed upon them in this country, and the flesh pronounced excellent. One great point in connection with these flowers, as a commercial article, is that the crops are never known to fail. Mr. Lockwood further says that the oldest inhabitant in Monghyr had never heard of a season when the mahwa crop was not abundant, for the flowers are always produced in great quantity, whether the fruits afterwards ripen or not. The extraordinary keeping quality of the mahwa is also another recommendation to its introduction into England. Before leaving India, Mr. Lockwood had a ton of these flowers shovelled into sacks and put on board a vessel at Calcutta. They were gathered in April, 1876, and after being kept for nearly two years were as good as when first dried. Mr. Lockwood thinks India would benefit greatly if mahwa flowers met with a demand in England. The vast forests of mahwa trees, which now yield little profit to their owners, would soon become a source of wealth, and the collection of the corollas would give work to thousands of poor people who at present inhabit the rocky country where the mahwa grows. The merits of these flowers for distilling purposes and for feeding cattle seem to be—1, cheapness; 2, unlimited supply; 3, certain yield; 4, nourishing qualities; and 5, good keeping qualities. Besides these uses to which the flowers of *Bassia latifolia* have been suggested for adoption in this country, the oil obtained from the seeds has also received some attention. It is used to adulterate ghee, or clarified butter, and Dr. Cooke, in his report on "oil seeds and oils in the India Museum," says the oil was long since submitted to Price's Patent Candle Company, and its applicability for candle manufacture ascertained. The report states that it is worth in this country, for the manufacture of candles, £5 per ton less than Petersburg tallow. A great many experiments had been tried with it, and it was found to be of the same value as cocoanut oil, as its being harder compensated for the colour being inferior. Large quantities, it was said, could be used in this country at about £35 per ton. This statement was made two years ago, and the value of the oil may have changed since then. That India is extremely rich in oil seeds, a glance through Dr. Cooke's report will show. Apparently there is a wide field here for commercial enterprise. In referring to this subject, a paragraph in Mr. Simmonds' *Journal of Applied Science* goes, I think, quite to the point. We are there reminded that the exports of oil seeds from India are becoming very important, and that India now exports oil seeds to the value of five and a half millions sterling a year, instead of making oil of them there and using the refuse for manure and cattle food, to say nothing about the extra cost of freight. Some vegetable oils are of course exported from India, such, for instance, as castor oil from Calcutta, and gingelly oil from Madras. But European capitalists are wanted to establish oil mills in India, and give their names as a warrant for standard qualities, and then India might hope to make oil one of the chief articles of export. Clever enterprise would soon be amply repaid. There are of course some oil mills in the country, but very few, and in these the oil is by no means made so cheaply as to leave no room for competition. The loss sustained by the country from the exportation of the seeds themselves is simply enormous. In one year four million cwts. of material for oil-cake is sent away, while the cattle are dying of hunger. I give you this for consideration, in the hope that, if the facts are not to be controverted, some steps to remedy such a loss to India may be taken.

It is extremely difficult to particularise any plants specially suited for investigation, as likely to prove commercially valuable; the difficulty is not to find them, where there are so many to select from, but to know which to take first. One man, however, might be specially interested in food products, another in drugs, another in timber, and so on. To the first I would say,—Are there no Indian fruits that we know little or nothing of at present in this country, that could be sent here, if not in their fresh state, preserved in syrup, or candied with sugar? I may instance, perhaps, a few. The guava, for example, is not so well known with us as I think it might be. Guava jelly and preserved guavas we do occasionally see, but they surely might be brought in larger quantities, and sold at a price to bring them into more general use. Then again the rose apple (*Eugenia jambos*), and the fruits of *Eugenia malaccensis*, are quite worth consideration. I have quite recently had an opportunity of tasting candied rose apples from Jamaica, the tree having been introduced into the West Indian Islands, and I can speak highly of their quality, the rose flavour being preserved sufficiently to give them a grateful taste. I am informed by Mr. Robert Thomson, sometime superintendent of the Botanic-gardens, Jamaica, that these fruits are produced in very great abundance, and could be sent into this country in any quantity; steps indeed are being taken to introduce them to commerce. Of course there is the difference of distance between this country and the West and East Indies, and the consequent greater length of time occupied in transit, and increased expenses of carriage, but if other products can be brought from the East into this country, and sold at a low rate, and yet prove remunerative, I do not doubt that these fruits might also become articles of trade. The loquat or, as it is sometimes called, the Japanese medlar (*Eriobotrya Japonica*), though a native of China and Japan, is largely cultivated in many parts of India. The fruits, which are oval, about the size of a plum or small apple, have a sharp, and sub-acid flavour, and are used as a table fruit as well as for preserving; this fruit might perhaps be found worth introducing preserved either in sugar or syrup. I will only just refer to the names of the blimbing (*Averrhoa bilimbi*) and the carambola (*Averrhoa carambola*), fruits well known in India by cultivation, and valued for their acid flavour, to show that amongst fruits alone there is a wide field for experiment; and, as a further illustration of how unlikely things are utilised, I may mention that in the Java collection of the Paris Exhibition last year, some peculiar looking fruits attracted my attention, which, upon closer examination, I found to be those of the nutmeg, the fleshy pericarp of which had been scolloped or ornamentally cut and rolled back, the whole being preserved in syrup, and forming a very agreeable-looking sweetmeat. Another apparently unlikely fruit to be of any service out of India, where, in Cashmere, we know it is used, is the singhara nut (*Trapa bispinosa*) the fruit of an aquatic plant closely allied to the water chestnut of the French (*Trapa natans*). The extended cultivation, however, of this plant has recently been proposed in India, and it is even been suggested that the fruits might be sent to this country. I need not dwell on this point, since it has been fully described at pages 174 and 175 of the *Journal of this Society* for January 31st last. In the matter of drugs, the medicinal plants of India are so multitudinous that it is utterly impossible to point out more than two or three by way of example. Professor Bentley and Dr. Trimen's work on "Medicinal Plants," has, no doubt, been the means of drawing attention to many plants which, though official in the Pharmacopœia of India, are still unknown so far as medical practice is concerned. Thus, a common leguminous tree, known as *Butea frondosa*, yields a resin known as Butea or Bengal kino, which exudes from the trunks of the trees either spontaneously or by incisions; this kino is an official remedy in India, being used in the same way as the ordinary kino of commerce. Other species of *Butea* help to furnish this kino, which is not altogether unknown in this country, being occasionally used as a tanning and dyeing agent. The seeds of the *Butea frondosa* have a considerable reputation in India amongst the Mahommedan doctors as a febrifuge; their use, however, is said to be sometimes attended with ill effects, hence further observations on their action is desirable. The oil obtained from the seeds is used as an anthelmintic. Some further researches in England on the products of this tree might lead to advantageous results. Another important medicinal plant included in the Indian but not in the British Pharmacopœia is the *Dipterocarpus turbinatus*, a large tree found in the forests of Eastern India from Chittagong and Pegu to Singapore. By incisions made in the trunk,

and by the application of heat, a balsamic exudation flows. The average produce of the best trees during the season is said to be sometimes as much as 40 gallons. This oil, or oleo-resin, is known as gurjun, or wood oil, and is described as being an effectual diuretic, suitable for use as a substitute, or in place of, copaiba balsam. It is not impossible that ere long we may hear something more of this oil in our hospitals.

In the matter of new woods, whether for building or cabinet purposes, time will not allow me to enter. It is a question, moreover, that may safely be left to the forest conservators. Suffice it to say that the first consignment of Indian timbers for commercial purposes arrived in this country not many months since, some of which were favourably received. In view of the scarcity of boxwood from the Caucasus, the possibility of India coming to the rescue is a fact to be thankful for.

With these few suggestions, which might have been extended *ad infinitum*, I will draw my remarks to a close, hoping that my poor attempts to draw attention to Indian plants adapted for commercial purposes may not have been uninteresting, and, moreover, may lead to some further development of India's resources.

DISCUSSION.

Mr. Christy thought the Society was much indebted to Mr. Jackson for his remarks. He mentioned the chalmugra seed as having been known for many years; and from information he had received, and papers that his cousin, the late Mr. Daniel Hanbury, had published, it appeared that it was known for many centuries in China, being always brought from India. It was very rare to find it in a pure state, one reason being the great expense, and the Chinese almost always adulterated it. He had had immense difficulty in introducing this oil here. He was on the committee of St. Peter's Hospital, and having this oil here, and having used it for one of his children with marked success, he placed it on the committee table for the surgeons, and begged them to use it. They thought the smell would be objectionable. Having waited a month, and nothing being done, he attended the surgeons and stood by them when they were seeing their out-patients. Knowing them intimately, he suggested—Is not this a case for gynocardia? They said, certainly. In a few minutes another case came forward, and he suggested it should be tried in that also, and as the man was asked to come again in a week he took care to be present. The surgeon was very much surprised by the result, and in the second week the man was nearly well. The surgeon said, "Be sure you come next week," and on the next occasion he seemed quite cured. These were cases of skin disease and syphilis, and were most trying. The surgeon then said there was really something in this oil, and he took it into regular use, and the result was most satisfactory, and he hoped there would soon be a report upon it. He had also sent it to Mr. Treves, at Margate, who had a great many cases of scrofula, and he had also tried it with marked success. He merely mentioned this to confirm the remark of Mr. Jackson, showing the difficulty there was in getting anything new tried. A gentleman in a Government office, knowing he was working at these new things, asked him if he could tell him of anything which would cure his brother, who was suffering from rheumatism and was almost stiff with it, and who had been getting worse for 25 years, the only relief he could get being from chloral. He told him he could not take any responsibility, but if he liked to try some of the oil he would give him some. The brother took five capsules each containing five drops of the gynocardia oil, and on the sixth day he dressed himself and went out, and he had been well ever since. He now carried about a bottle of the oil with him. That showed what might be done if people would only work with these things. The Chinese had been working with this oil for 500 years. The week before last, he was in Paris, and was asked to meet some of the surgeons there. They said it was a very singular oil, and that it sometimes produced indigestion. He said he knew it did, but it was quite safe, as far as he knew, if taken on a full stomach. He was sure, if this was worked at in our hospitals, there would be an enormous demand for this oil. Thymol was also a very valuable drug. Tamarisk galls, again, were entirely unknown in England. It was known, since Ramspecker discovered an apparatus for testing the exact value of tanning materials, that galls only assisted the tanner by opening the pores of the skin, to allow tanning substances to enter; but it was formerly believed that the galls themselves assisted the tanning operation. Now, these tamarisk galls had been brought over many times, but very few tanners knew anything about it; it collected in the docks, and was sold at the rummage sales. Tanners were very anxious to get it in quantities. *Balsamocarpon* was now growing in India; he had sent some seed to India and Australia, and it was the richest tanning substance in the world, containing 90 per cent. of pure tannin. He also showed a specimen of russot. This was being used by some of our oculists, it had been used for a long time in India, but no report had been issued upon it. The mahwa he had also worked at. He had had some of the fruit in a sack since 1876, and there was no change in it whatever. The fleshy corrolla fell from the trees as had been described, and it was eaten with avidity by all kinds of animals, even the carnivora. Some was taken to the Zoological gardens, and there was hardly an animal or bird there but ate it readily. He sent some to Paris, where there are so many professors that they were always anxious for something new. They tested it for spirit, and their report was that it contained the very highest class of spirit they had had submitted to them and yielded a larger percentage than any fruit hitherto tested, and they could hardly believe that it was a flower. It was very singular that this fruit could be landed in England from India at 6s. a cwt., and if six gallons of proof spirit could be made from the cwt., it would be very profitable. It had been offered to the distillers, and they said they should be glad to give £8 to £9 a ton for it. He had written to India for 20 or 30 tons, and though there were difficulties about the transport, he hoped it would soon be sent over.

Mr. Hale said he believed that England, with the produce of India, might be independent of all the world; and he thought representations ought to be made to the Indian Government to try these products, and send over larger quantities, so that the resources of the country might be developed.

Mr. Holmes agreed that it would be wise if the products of India were examined there instead of at home, and some of them sent over here for commercial purposes. One reason why products were neglected was because many of the things sent over were of very little value; another reason was that they were not sent over in sufficient quantities. If Government were to send over some of the products which were considered most valuable by the ton, and put them into the hands of thorough men of business, many of them would speedily be introduced. At present they simply figured in museums, and there were no opportunities for commercial men to test them. He was especially interested in drugs, and on them Mr. Jackson's remarks were very valuable. Indian aconite, especially the Nepaul, when it could be obtained, was eagerly bought up for the manufacture of the alkaloid, because the active in Indian aconite was more powerful than the German. If it could be sent over at a paying price, it would be sold in large quantities. The opium used in this country did not come from India, and it was difficult to find a specimen in this market. It all came from Smyrna, Persia, and Egypt. Now India was a great opium-producing country, and he saw no reason why, if prepared of good quality, it should not be largely used; it only required more care in the preparation. Thymol was another instance of what might be done by a little business energy. It was a powerful antiseptic, and derived its name from occurring in the common thyme; it was now coming largely into use, being safer and less irritating than carbolic acid. With regard to russot, as a rule the extract was rather impure, and appeared to be used from the earliest times, in India, as an application to inflamed eyes. It probably owed its good properties to ferberine, which was also found in India. Dr. Dymock had lately sent him over some mangosteen fruit, unripe, preserved in syrup; the flavour was very pleasant, and it occurred to him that if it were once tasted, it would be much inquired for. Mr Jackson also alluded to the gingelly balsam, which had been brought into notice as a substitute for copaiba. In leprosy it certainly did not answer as well as chalmugra oil, but it was very cheap, and it would no doubt find numerous applications in the arts if not in medicine. He could quite confirm what Mr. Jackson had said about the chalmugra oil. He had lately read a letter from a chemist in the Mauritius, who said it was impossible to obtain pure oil from India, and that he always sent for the seeds. He found the oil obtained by boiling the seeds was stronger than that obtained by cold expression.

Mr. Routledge said he, unfortunately, had no samples of bamboo with him, or he should have been pleased to show them. The subject was of immense importance to paper makers, who at present were almost entirely dependent on foreign counties for their main raw material, *viz.*, esparto grass. He was sorry to say that this material was being more rapidly exhausted than he had deemed possible; only a few days ago he had samples of Spanish grass submitted to him, some of which was not more than 4 in. long. The fact was, it was overpulled, the roots were laid bare, and the winter rains washed away the soil, so that the root stools became impoverished, and in many districts the plant had almost vanished, where hundreds and thousands of tons grew formerly. The largest supply now came from Africa and Algeria, and there it was going through the same process of exhaustion from the same causes. It was therefore necessary, if the manufacture of paper were to continue, that some new material should be discovered; for makers were now reduced to using things such as ground wood pulp, china clay, and other matters which never ought to be put into paper. Some of the cheap papers almost fall to pieces in your fingers. For sometime past he had been turning his attention to bamboo, believing, from investigation, that it would prove the best and cheapest material which could be used, and possessing also the enormous advantage of being produced in illimitable quantities in India. The Chairman would bear him out that three-fourths of the country produced bamboos; in fact, it grew almost anywhere where there was moisture. There had been a controversy going on for some time between him and Dr. King, curator of the Botanical gardens at Calcutta, as to the cultivation of this plant in India, the latter maintaining that it could not be grown or cropped. He believed it could, and he had proved that it would make most excellent paper. The pamphlet Mr. Jackson referred to was printed on paper made from bamboo, and better paper he did not want to see. Dr. Winthrop, the Commissioner of Forests in Burmah, was collecting bamboos for him, and he wrote him that they could be landed at Rangoon and floated down at a cost of Rs. 15 per 1,000, weighing from six to eight pounds. When dried they lost about 60 to 70 per cent. of moisture; so that practically, a ton of dry raw fibre would cost 8's., and that would produce a ton of paper. The bamboo gave the greatest yield of any material he was acquainted with, except perhaps one, the paper mulberry tree. All fibres have to be submitted to a boiling process, during which they lost a large quantity of extractive matter, varying from 40 up to 60 per cent. of the weight of the plant. The bamboo only lost 40 per cent., whilst esparto was supposed to lose 56, but in practice, it was about 46. The test of a fibre as regarded its commercial value was, first, what quality of paper it would make, and next what it would cost to produce the paper. Th

longest price of esparto at present was £6 a ton for the raw material, or allowing for a loss of 50 per cent., £12 a ton. The bamboos could be floated down at cost of Rs. 15 (30s.) for 2 tons of dry material. The unfortunate part of the matter was, that India was such a long way off, and bamboo was very light and bulky. It also contained a large quantity of moisture, so that, if crushed, it had a tendency to ferment and rot. For these reasons he believed that, to make it pay commercially, it must be treated on the spot, and sent over in the condition of what was called stock. The point at issue was whether it could be grown and cropped. By the last mail from Demerara he received two letters, one stating that for three years the writer had cut down whole bamboos, and he did not see any depreciation in the succeeding growth. In the other letter the writer said he had seen bamboos flowering on his estate, and they remained healthy afterwards. The theory in India was, that when a bamboo flowered, it died. There were very many varieties of the plant—probably about 120—and the majority were supposed to attain maturity in about 40 or 50 years, when they flowered and died; but in the West Indies that did not seem to be the case. This gentleman said he had them cut down and burned, and, in a few months, they were as flourishing as ever. He had several other letters to the same effect. The one thing the bamboo seemed to want was a damp, moist climate; it was useless to attempt its cultivation where these conditions were wanting, but in Burmah, where the rainfall ranged from 120 in. to 160 in. all up the west coast, it flourished in great abundance. He had letters from the Assistant-Conservator of Forests there, who had travelled over ther whole country, right up beyond Pegu, and he said that the natives cut it about anyhow they liked, and the more they cut it the better it seemed to grow. He believed the safest plan would be to cut a certain portion of each clump every year—the young shoots; but if a plantation were made, as was done with sugar, rice, jute, and other things, it would minimise the cost of collection and carriage, and it could then be irrigated if necessary. If so grown, he believed you could get enough bamboo for 20 tons of paper per acre. We should then be independent of France, Spain, and Africa and he feared the French Government might before long, impose a duty upon esparto, seeing it was an article of such prime necessity. It was an absolute necessity in these days that we should have paper, and he wondered that this question had been allowed to lag so much. For his part, however, he did not intend to relax his exertions until he had brought them to a successful issue.

Sir Joseph Fayrer said Dr. King was a most eminent practical botanist and if he said the bamboo would not grew in Southern India, it was difficult to question it, but he certainly accepted the statement with the greatest diffidence. He believed if the bamboo would grow anywhere, it would grow in Bengal, and in Burmah. He could not conceive how any one who had lived and travelled in India as he had done, and seen the magnificent clumps of bamboo, even in and about Calcutta itself, could maintain that it would not grow. By judicious cultivation, he had no doubt it could be cropped regularly. He had no idea that it had such a great commercial value, and it seemed to him a thousand pities that it should be neglected; and he hoped what Mr. Routledge had said would be acted upon. He might also allude to the kindred subject of arboriculture. The mahogany tree, although an exotic, grew freely in India, and some splendid trees which were blown in the Calcutta-gardens by the last cyclone, were sold for cabinet making, at prices equal to that of the best timber from Honduras. He had often wondered why the roads in Bengal should not be lined with it; it formed a magnificent shade, and the wood was very valuable. Dr. King was a most excellent and energetic curator, and he felt great difficulty in suggesting anything which might appear in any way to controvert the opinion he had given, but he could not help thinking there must be some mistake about it. He regretted the paper was not longer, but it was quite sufficient to indicate the direction in which search was to be desired. It was very desirable, however, that many of these things should be more used in India itself. India was indebted to England for many products which she could produce as well herself. The impetus had already been given, and many things were now sent over here which a short time ago were quite unknown. The chalmugra oil was well-known to him, and it was a most valuable medicine.

Mr. Francis Cobb said that many present probably were not aware of the obligations they were under to Mr. Routledge for his experiments, and the perseverance with which he had followed up the question of bamboo for paper-making. His idea was to bring the bamboo to a certain stage in India as shown by a small specimen which he would hand to the Chairman. This was not the first time Mr. Routledge had told them about the bamboo, and he was surprised that it had not been taken up to a larger extent. Bamboos were constantly brought here in the shape of dunnage, but they arrived in such a condition as not to be so fit for the purpose of paper-making as if it could be brought in the condition he had shown. The outside was hard, flinty, and unmanageable. But it was evidently erroneous to suppose that the bamboo could not be utilised and become a valuable export from India, as was shown by the practice of the Chinese. They cut off the young shoots and ate them, and split up the young bamboos and made use of them in all sorts of ways. On the other hand they let some grow so large that they made buckets of them. If the Chinese could treat them in this way and still have a constant supply, he could not see why it should not be done in India, especially if they were grown in plantations. Mr. Jackson regretted that oil seeds were exported instead of expressing the oil in India, but it appeared to him that the oil could be much better expressed in England, and the profit arising from the process was in the form of a bye-product—the cake, for which there was a good market. He doubted if anything like could be found for it in India, where they did not fatten bullocks for eating. The price of the cake here was about £2 a ton, and he did not think anything like that could be obtained in India. The bamboo, however, opened a prospect which there was no seeing the end of.* The greater the quantity supplied, the greater would be the consumption, especially as esparto was failing, and in a few years would be at such a value that it would be no longer available for paper-making. If there was a country in the world where opium was raised, it was India, and probably Mr. Holmes was referring to laudanum; but he believed that where Turkey opium could not be obtained, the Indian had been used for making the tincture. So long as the medical man knew what he had, the Indian was as good as the Turkish, and it was merely a question of the rules of the British Pharmacopœia as to what should be called laudanum. No mention had been made of rhea grass, which, if cultivated in India, would form a very valuable export. It was known here chiefly as China grass, but it might be cultivated largely in India. There were also what was called vegetable, silk or wild silks which were worthy of more attention.

Mr. Routledge said the first experiment he made with bamboo, some five or six years ago, on the ripe, matured plant, but it did not answer well. The young bamboo sprang from the seed of the old plant, and it took about 15 years before it became silicious. No matter what species it might be, it went on maturing for a series of years, and being an entogenous plant, it grew until the inside got filled up and it could grow no longer. It could then no longer transmit the sap, its pores, or vessels, became ossified, like the veins of an old man, and it died, having first seeded. The bamboos which came here as dunnage were cut indiscriminately from the clumps, irrespective of age, and in the older ones the exterior portions had got so indurated with silica, that it took an enormous quantity of caustic soda and high pressure boiling to make it manageable. It was then no longer a fibre, but a pulp, which was difficult to dry, and would only produce inferior paper. If they wanted to make paper from wood they need not fetch bamboo from India, because they could get it much cheaper nearer home. After making these experiments on the old matured wood, and finding the difficulties he had to contend with, he was induced to try what he could do with the young plant, and he found, much to his gratification, that very much like esparto grass when the plant was cut with the sap ascending, the young shoots, which ran up 50 or 60 feet high, it could be reduced by gentle boiling into the consistency of cheese, and might be treated with the same felicity as esparto; in fact, it was just like cooking a ripe cabbage, or asparagus. In fact, in the Malaccas, and Maluccas, the young shoots of some species were used for food, and were frequently put in pickles and chutnees.

Mr. Bowden said he should be happy to place five acres of ground, in the Godavery district, under irrigation, at the disposal of any one who would like to experiment on bamboo cultivation free of rent. There were cheap means of transit from there to the port of Coconada.

Mr Geo. Hogarth asked if rhea, one of the most beautiful fibres, was produced in India. He was sorry to say that it was losing ground, the entire responsibility of which lay with those who produced it and prepared it for the market. It was so carelessly put together, that the great bulk of it was useless for anything but paper-making, simply because it was all twisted and gnarled, and there was no possibility of getting it straight. When properly garnered, there was nothing to equal it except silk, and it was being manufactured into every thing a lady could adorn herself with, but, as he had said, it was losing ground from the bad state in which it came over. The price ranged from £5 to £ 80 a ton, which showed what a margin there was to pay for careful preparation. He understood that hitherto it had been retted entirely by hand, which was very expensive, though labour was cheap. The Indian Government had offered prizes for machinery to do it, but hitherto nothing satisfactory had been devised.

The Chairman said the rhea which came from India was often badly prepared, but the China grass was beautifully prepared, and could be obtained in any quantity.

Mr. Hogarth said all he had seen was the common China grass. He understood that a great deal of the difficulty lay in the gathering; if it was not ripened sufficiently in the sun after cutting, there was a deal of acid left in it, which made it snarl in the process of manufacture, and prevented it taking the dye.

Surgeon-General Balfour thought a good deal might be made of the various products of India. Bamboos were grown in enormous quantity on the west coast, they were never shipped, on account of their great bulk, but were made up in rafts and lashed to the sides of the coasting vessels. The great question with all Indian products was—would they pay? and he believed that most of those which would do so were already brought to Europe. The natives were well alive to their own interests, and are not much disposed to make experiments unless they could see their way to a profit. He doubted if it would be possible to obtain a large quantity of chalmugra oil, but there was no doubt of its value. He believed it was the oil which the late Dr. Bhau Dajee used in the cure of leprosy, but both he and his brother kept it a secret. There was a great difficulty in getting it pure. Nearly all the eminent medical men who had written on India and its products had drawn attention to the various commercial products, but it did not seem to produce much effect. There was abundance of opium in India, and he did not know why it did not come to England, but he believed that some of the active properties were more abundant in the

Turkish opium than in that of Bengal. The great difficulty with many articles was their great bulk, nevertheless enormous quantities of jute were now brought here, and quite a large industry had grown up in Dundee and elsewhere in its manufacture. One great difficulty in exporting oils was in obtaining the barrels to put it in. At one time a considerable trade was done in solidifying castor oil, by a process invented by Mr. Loarer, so that it could be sent home in blocks. That lasted for a few years, but it did not seem to have been continued.

Mr. Christy wished to utter a word of warning to Indian exporters. He had learned that week that it was with the greatest difficulty that manufacturers could now use Indian shellac, owing to the quantity of resin and other adulterations which were mixed with it. The people of India had been down on the English manufacturers for charging their cotton cloths, but we could certainly retaliate on them for charging their shellac with resin. With regard to the expression of oil and the use of the cake, he might mention that the Chinese found it pay very well to use the cake, direct on the land for manure.

Mr. Cobb suggested that this was not oil cake but pea cake.

Mr. Christy said that was so. Mr. Routledge's views about cropping the bamboo were quite correct. In China they kept regular plantations which were constantly cropped, and descended from father to son ; a certain quantity was cut out of each clump every year.

Mr. Holmes added, with regard to opium, that the best authorities on the subject said that the better qualities were not prepared in sufficient quantity to export to England. It was the Patna opium which was chiefly used in the hospitals. Some said it contained more narcotine and less morphia than that from Asia Minor. The fact of its not appearing in the Pharmacopœia would not stand in its way if it were equally valuable, because the Persian opium, which was not named either, was largely used by the makers of morphia when Smyrna opium was dear. The Indian opium, he believed, was prepared in a different way, being brought home and stirred up into a paste, whereas the Smyrna was made directly from the capsules ; and probably this affected the quality.

Mr. Cobb thought the true reason why Indian opium was not used was, that the percentage of morphine in it was uncertain ; so that, when you gave a patient 30 drops of laudanum, you might really be giving him the equivalent of 45. Hitherto, also, the Turkish opium had been landed in England rather cheaper than the Indian.

The Chairman proposed a vote of thanks to Mr. Jackson. All the products he had mentioned had a future, and probably a considerable future, before them ; but he would call attention to another product which had not been mentioned, for which we paid on an average upwards of 30 millions sterling per annum, *viz.*, wheat. He had placed on the table a number of samples of Indian wheat, which represented 1,100 or 1,200 specimens sent from all parts of India. The samples came from some 60 districts, and they were equal, and even superior, to the finest wheats which came into the English market. The average price of English wheat at the present time was about 39*s.* a quarter, but that of the samples referred to went as high as 47*s.*, and some of them weighed 65lbs. to the bushel. It might not be known to all, but India was, next to the United States, the largest wheat-producing country in the world, the annual crop being about 30 million quarters, 10 to 11 millions in the Punjaub—about as much as the whole production of England—10 millions more in the North-West Provinces and Oude, and the remainder in other districts. The average production in America was about 38 to 40 million quarters. There had been a remarkably good crop last year, and this together with the universal commercial depression and want of confidence, which prevented importers holding large stocks, was one cause of prices being so low, lower he believed than they had been during the present century. He believed there was a great future for the Indian wheat trade. The year before last we imported upwards of a million quarters ; this year the supply had fallen off on account of the demand in India itself, but by the opening of the Scinde Railway he thought they might look to the day when the Punjaub alone would be able to send us a very considerable quantity, for it produced more wheat per head of population than any other part of India. When the Indus Valley Railway was opened, especially when the bridge over the Indus was completed, the reduction in the cost of carriage, as compared with going to Calcutta, would be equal to about 8*s.* a quarter, enough to make all the difference between a paying and a non-paying trade. Prices at present were exceptionally low, but were not likely to remain so, and with a slight rise he thought there would be every possibility of obtaining large supplies from India at a profit. This was a matter of extreme importance both to England and India, and might have an important influence on the silver difficulty with which we have to contend at the present time. The finest wheats at the Paris Exhibition were not superior to some of these from India.

The resolution having been passed, Mr. Jackson, in acknowleding the compliment, said Mr. Christy had fully borne out what he said as to the prejudice against new products. With regard to Indian opium, the greater part of it was sent to China, where it was illegal to produce it ; but still a good deal was made, and he believed the Chinese Government were contemplating allowing it. He must apologise to Mr. Routledge for not having asked him to bring some specimens of bamboo, but the subject had entirely slipped his memory. He had referred to the *Brucinicia paperifera*, which was a remarkably good paper-making material, and was well known in Japan. There were two species form which they made nearly all their paper. By treating it with oil, they made it transparent, and used it for glass : and, by putting several layers together, they formed a material similar to leather, which they used for book-binding and other purposes. The utilisation of rhea fibre in this country was another illustration of how difficult it was to introduce new substances. About 25 or 30 years ago, this fibre was brought prominently under notice by the late Sir William Hooker, and it was sent to several British colonies, but nothing more was heard of it until 10 or 15 years ago, when it cropped up again in a most remarkable way. The American Consul at Bradford had sent a report to his Government, drawing attention to this fibre, and pointing out that it might be introduced into some parts of the States. This report fell into the hands of the British Government and was sent to Kew, with a request that the plant should be introduced there, and asking whether it was suitable for introduction into any of the British colonies, exactly what had been done long before. It was then again introduced into the West Indies and other colonies ; but it again died out. The Indian Government had offered a large premium for a machine for clearing this fibre in India, because as he understood the great difficulty in the manufacture was the large quantity of gum contained in the bark, which rendered it necessary that it should be cleaned and prepared in the green state. For this purpose plants were grown in the South of France, so that, they might be experimented upon. It was a hardy plant, and grew very well there. Some of the specimens in the Kew Museum were extremely fine, and he saw no reason why it should not be largely grown. Why it was not brought into more use was one of the mysteries which seemed inexplicable.

In connection with the above the following corrections which have subsequently appeared, deserve the attention of the reader.

In the discussion which took place after Mr. Jackson's interesting paper on the above subject on Friday, March 7th, some slight inaccuracies occur in the report of my remarks, which I beg space to correct.

The Conservator (not Commissioner) of Forests in British Burma, who is kindly collecting young bamboo stems for me, and floating them down to Rangoon for crushing, to come to our works here for extended experiments, is Dr. Berthold Ribbenthrop, and to this gentleman I am indebted for much very valuable information as to the habit, cropping, and cultivation of bamboo under irrigation.

One thousand young seasons shoots will weigh from six to eight ton (not pounds), which, losing from 60 to 70 per cent. in drying, and allowing amply for waste, will yield, when converted into stock, sufficient to make one ton paper. These young stems will cost about Rs. 15, say 30*s.* per 1,000 delivered by rafts at Rangoon.

My two informants from Demerara tell me they have cut down entire clumps of bamboo during successive seasons without apparently deteriorating the growth, and one states that even burning the clumps down to the ground has not prevented successive growth, adding that he had seen bamboos seeding on his estate and remaining in healthy growth afterwards, but then it must be noted Demerara is a moist climate and soils suited to the habit of growth of the bamboo.

In a few succeeding remarks, I intended to show that in treating the old and matured bamboo stems I had not succeeded well, inasmuch as they had become wood, and very hard siliceous, or silicified wood, too—and that similarly to other woods they could only be reduced into a pulp by boiling under high pressure with very costly doses of caustic soda—but that when subsequently experimenting on the young shoots in the vegetable or growing stage, with the sap freely circulating, and before silicate and other compounds had become deposited and indurated, I found that, with the gentler boiling and reduced chemicals, I could treat the stems as readily as esparto grass, indeed, just like cooking a ripe cabbage or asparagus in its succulent stage, reducing them into long and strong fibre.

The question, in fact, of making paper—and good paper, too—from bamboo, is settled. The other question to be determined (by the botanists) remains, *viz.*, whether the bamboo can be continuously cropped every season to allow the young shoots to be utilised ; and, speaking for myself, I have not a vestige of a doubt that, if this operation is judiciously conducted, success will result and thus a valuable commercial product be added to the exports of India, while assisting our English paper trade, which sadly needs an extended supply of suitable raw material.

THOS. ROUTLEDGE.

Claxheugh, 17th March, 1879.

In the course of the discussion following the paper on "Indian Plant, Adapted for Commercial Purposes," by Mr. J. R. Jackson, Mr. T. Christy is reported to have said that he found great difficulty in inducing medical men at a certain hospital to try chalmoogra oil. This is so very different from our own experience, that we think the members of the Society of Arts will be sufficiently interested in it to warrant us in begging that you will kindly insert this letter in your next issue. In the course of a very general introduction of chalmoogra oil, in which we have interested ourselves now for more than a year, the difficulty spoken of has never been experienced by us. We have placed the oil in, perhaps, every large hospital in London and in some of these it is now being regularly used ; we have received orders for it from various parts of Scotland and Ireland, and from scores of medical men and chemists in England, who now regard it as part of the ordinary *Materia Medica.* We have also sent the oil to Belgium, Germany, France, North America, the Cape, and Australia

and altogether have distributed some four hundred pounds, not a small quantity in the time, if it be considered that the dose is small, that most of the cases in which it is used are chronic, and that no systematic report on the cases treated has yet appeared. We were pleased to see the unqualified commendation of chalmoogra given by Sir Joseph Fayrer, and Surgeon-Major Balfour. We hold numerous letters from physicians and patients recounting the salutary effect of the oil, but have preferred to file these, pending the more formal and authorised reports. Our experience will show you and others interested in the discussion above referred to, that medical men are not averse to the use of new remedies which come well recommended, and which are brought properly before them. With regard to the supply of it, our sources are so abundant that we do not share the doubt expressed by Surgeon-Major Balfour as to the possibility of obtaining a large quantity of chalmoogra oil. We hold a good stock of the pure oil at the present time, and it is not likely that our arragements will be at all strained, unless a very much larger demand than our experience leads us to anticipate should suddenly arise. In connexion we would refer you to a preliminary paper on the chemistry of chaulmoogra oil by our partner, Mr. John Moss, which appeared in the *Chemist and Druggist*, December, 1878, and to a pamphlet by Mr. R. C. Lepage, late of Calcutta, in which you will find all that has hitherto appeared on chalmoogra oil carefully compiled. We may say that the appearance of this pamphlet was the first important step in our systematic introduction of the oil to medical practice outside of Hindostan.

800, High Holborn, London, 18th March 1879.

CORBYN, STACY, AND CO.

RICE IN JAPAN.

THE Japanese, writes Mr. Mounsey, in a report to the Foreign Office, accord a high antiquity to the origin of the rice plant in their country, their legends stating that it sprang from the body of the daughter of the God of Clay and the Goddess of Fresh Water. They also attribute to this plant the pre-eminent virtue of keeping away evil spirits, and readers of their lore will well remember the first instance of a manifestation of their belief in this virtue. It occurred when the Sun Goddess was induced to leave her dark cave by a variety of cunning devices, but more especially by the curiosity and jealousy excited in her breast by the reflection of her unconscious charms in the fatal mirror; for, being forthwith carried off to a new palace, her abode was at once and henceforth protected by encircling ropes of rice-straw. The wide diffusion of the popular faith in this virtue is evident from the facts that ropes of the same material are to this day stretched across the portals of all Shinto shrines as a protection against evil spirits, and that they are prominently used, with the same intent, in all New Year's Day decorations. Until lately the measure of a man's wealth and income was calculated in rice, and it was almost universally used as the medium for the payment of salaries, wages, and taxes—as the standard of value, in short, in most of the daily transactions of life. Even now the principal item of national revenue, the land-tax, is paid to a considerable extent in rice, one year's experience of the law enforcing money payments having sufficed to show that their continued exaction would be unjust to the farmer. Finally, of all the products of the field, rice is held in the highest honour, and there are, no doubt still many Japanese who are at a loss to imagine how life can be sustained, or the concerns of a nation carried on, without it. It is evident, therefore, that from very remote times rice has been one of the great staples of agricultural produce in Japan. The rice produce of Japan is about double what it was two and a half centuries ago. About a tenth of the entire area of the country is under cultivation, and of this a tenth are rice-lands, a year's crop being estimated at nearly 136,000,000 bushels. Rice, however, is not the staple food of the whole people; large numbers of the lower classes living upon cheaper grains, such as millet, buckwheat, beans, &c., and only indulging in rice from time to time, and in small proportions. The cultivation of rice is more profitably exported to Europe, but it requires a great deal of extra care in storage and ventilation. The Japanese Government has, Mr. Mounsey understands, just ordered a supply of Java seed, and experiments are to be made with it this year. Their alleged reason for this measure is, that Java rice commands the highest price in Europe. They may also hope to obtain a grain which can be shipped on long voyages more easily and surely than the native article. The superiority of Japanese rice in nutritive power is due to the fact that it contains a far larger proportion of fatty matter than any other rice.

Various sorts of spirit and liqueur are also distilled from rice. Mr. Mounsey says:—"There are hard drinkers in Japan, as in most other countries, and, like most Asiatics, the Japanese seem to place less value on the flavour of their liquor than on its intoxicating power. They are certainly fond of carousing, and often given to excessive drinking at festivals and on holidays. This is more especially the case in large towns and in the capital where the results of a laxity of military discipline as regards the sobriety of the soldiers, is too often disagreeably manifest. But there is probably less drunkenness in Japan than in several European countries, and the rice does not there lead to the same fatal consequences. Saké contains such a large proportion of fusel oil that derangements of the stomach cut short the course of intoxication, which, in other countries, and with other liquors, results in *delirium tremens*, and this disease is said to be almost unknown in Japan. On the other hand, some European medical men have attributed the prevalence of paralysis and cognate maladies in certain provinces to the effects of saké, though their opinion is not that of the whole medical profession."

The Japanese Government still receive considerable quantities of rice in payment of taxes, and they are in the habit of purchasing more with their reserve fund for export to Europe, so as to avoid the necessity of remitting coin or bullion in liquidation of the interest on their foreign debt, and for the payment of orders for men-of-war, arms, &c. They are thus almost the only real rice merchants; for few, if any individual Japanese possess sufficient capital at present to enter into large business transactions, and the spirit of association necessary to the formation of companies is still feeble, and has not yet made itself felt in the rice trade. Mr. Mounsey is told, indeed, by European merchants, that it is impossible to obtain a full cargo of rice without applying to the Government. For this reason, and also from uncertainty as to the continuation of the permission to export the grain in question, European mercantile houses cannot embark largely in a trade which must virtually remain a monopoly until the Government ceases to speculate in it, and until it sells its rice at public auction, instead of, as at present, favouring one or two firms with its custom. Rice can, without doubt, be bought in small quantities from native dealers, and it is thus bought by Chinese merchants, but the bulk of the exportable grain belongs to the Government. Mr. Mounsey adds:—"Both political economists and experience condemn, I believe, the practice of Governments becoming traders. In defence of the Japanese Government it may perhaps be argued that a great deal of their rice comes to them in the shape of taxes, and that they are, therefore, justified in making the most of it. But as long as they continue this practice, and can arbitrarily stop the exportation of rice by any but themselves, it is evident that there can be little inducement for the farmer to increase his produce of this grain by enclosing waste lands, and that the rice trade with foreign countries, which might possibly become a source of considerable wealth to the country, cannot be developed to any great extent."—*Globe.*

POPULAR ERRORS REGARDING *PAPYRUS.*

IN Adams' "Roman Antiquities" the Egyptian papyrus plant is described as about ten cubits high, and as having several coats, or skins, one above another like an onion, which coats were peeled off with a pin, in the process of paper making. In Smith's "Dictionary of Greek and Roman Antiquities," it is said that the papyrus tree grows in swamps to the height of ten feet or more, and paper was prepared from the thin coats or pellicles which surround the plant. Liddell & Scott's Greek Lexicon says that "paper was made of the inner bark of the papyrus." And similarly other works of high character, encyclopædias and the like, give a false account of this interesting plant.

Calling attention to these misstatements, in the *Library Journal* Mr. Ezra Abbott, of Harvard University, says: "The papyrus plant (*Cyperus Papyrus* of Linnæus, or *Papyrus antiquorum*, Willd.) belongs to the family of *Cyperaceæ*, or Sedges; it is an endogenous plant, with a triangular stem; and to talk about its 'inner bark,' and 'layers' like the coats of an onion, is a simple absurdity. One might as well speak of 'the inner bark' of a stalk of Indian corn or of a bulrush. The error has originated from ignorance, or forgetfulness of the elements of botany, and the consequent misinterpretation of the passage in Pliny (Hist. Nat., xiii. 11-13, al. 21-27), which is our chief source of information about the ancient manufacture of paper from this plant. One of the words which Pliny uses to describe the very thin strips into which the cellular substance of the stem was sliced in making the paper is *philyræ*, which strictly denotes the inner bark of the linden tree, also employed as a writing material. Hence the papyrus has been conceived of as an exogenous plant, with its outer and inner bark, and has actually been called 'tree.' The botanists of course have not made such a mistake."

Mr. Abbott points out a still more absurd mistake in the English translation of Guhl & Koner's "Life of the Greeks and Romans," which says: "The stalk * * * was cut longitudinally, after which the outer bark was first taken off; the remaining layers of bark, about twenty in number *(philyræ)* were carefully severed, with a pin; and, afterward, the single strips plated crosswise; by means of pressing and permeating the whole, with lime water, the necessary consistency of the material, was obtained." The word mistranslated lime water is *leimoussera* which means glue water.

INDIAN COOLIES IN GUIANA.

We give insertion to the memorial printed below, at the request of the memorialists, who write to us from British Guiana, Gerogetown, Demerara. A copy of the same memorial has been forwarded to the Protectors of Immigrants at Calcutta and Madras. In the letters which accompanies the memorial to those gentlemen, a copy of which has been sent to us, the writers say:—" We have no one to protect us in this colony. The Immigration Agent-General ought to protect us. Instead of his doing so, he, the Immigration Agent-General, is endeavouring to do us more harm than good. He is not our protector, but our oppressor. We therefore solicit your assistance in the matter, and ask you to do all in your power to see redress given us, by your submitting our memorial to the Government of India."

To His Excellency CORNELIUS H. KORTRIGHT, ESQ., C.M.G., Governor and Commander-in-Chief in and over the Colony of British Guiana, Vice-Admiral and Ordinary of the same, &c., &c., &c.

The memorial of the undersigned Indian Immigrants introduced from India to the Colony of British Guiana, and who are residing in the said Colony.

MOST RESPECTFULLY SHEWETH,

1. That your memorialists were engaged in India to come to this colony and work as agricultural labourers, some of them for a period of five years, and others more recently for a longer term of service of ten years, and were informed that at the expiration of these terms, your memorialists and your memorialist's children, whether from India or born in this colony should be provided at the expense of this colony with a free return passage to the port from which they embarked.

2. Some of your memorialists countrymen have been provided, according to their agreements, with such passage to India with their children, whether born in India, or born in the colony.

3. Your memorialists, since 1876, have been deprived of their rights to free return passage, pursuant to the agreements made with them in India, and are compelled by the Immigration Agent-General to remain in this colony, or pay the passage-money of each children born in the colony and infants introduced from India, who were not under indenture on arrival.

4. Your memorialists pray that your Excellency will cause an investigation to be made into this matter and ascertain how and why, and by what authority, our agreements, made in India, are set aside and ignored and made valueless in this colony. Your memorialists beg leave to quote in support of the facts stated in this memorial, the case of a Madras immigrant, Pyneaundy, No. 200, ex *Martin Luther* 1846, who applied for a passage back to India for himself and four children in 1877, and was not allowed a free back passage, but was refused it, except he first paid the passage-money of his children born in the colony. Similar cases have been refused from time to time by the Immigration Agent-General, on account of the inability of the parents to pay the passage-money of their children born in the colony and children born in India, who were not under indenture on their arrival in this country. The clothing money which return immigrants are required to pay is a very large item to a poor and large family, and when in addition to the cost of clothing the passage-money of each member of the family, alleged to be not entitled to free back passage, is required, the parents frequently find it impossible to meet the demand for so much money.

5. Your memorialists think the Government of this colony is bound to keep faith with the immigrants from India, and to provide all the Indian immigrants, desirous of returning to their native land, with a free back passage for themselves and their children, according to the agreements entered into by the agent of this colony and your memorialists in India.

6. Your memorialists feel assured that they have only to bring these facts to the notice of your Excellency and the fullest investigation and inquiry will be made into the nature of their complaints; and justice done in the matter; for which your memorialists will ever pray.

[Here follow 36 names.]

COPROLITES.

A SUFFOLK country clergyman, (the late Rev. J. S. Henslow, deeply imbued with a love for natural history studies, while taking a seaside holiday with his family at Felixstow, had his attention arrested by certain dark-coloured stones which were plentiful in the cliffs of that part of the Suffolk coast, and under a belief (induced by his geological knowledge) that these stones might be the petrified digested food of pre-adamite sharks and sea lizards he sent specimens to London for chemical examination. The result was favourable to his theory. Analysis brought out the important fact that these black pebbles, hitherto looked upon as worth no more than ordinary road gravel or beach shingle, were largely composed of that ingredient so prized by agriculturists, phosphate of lime. The next steps in the history of this discovery and its application, were to collect these phosphatic stones in large quantities, reduce them to powder in stone crushing mills, and then experiment with them as a substitute for guano. The success of these experiments was complete; and it may be said, in a few words, that the natural history knowledge thus accidentally called forth in the course of a seaside ramble has laid the foundation of one of the most important applications of physical science in relation to national wealth that the 19th century has witnessed. Already this discovery has opened out new channels for the employment of human industry and labour. Thousands of the working population in the counties of Suffolk, Herts, and Cambridge are earning good and permanent wages by digging for phosphatic stones, known agriculturally as "Coprolite." Thanks to natural history, science and its happy application in the hands of a Suffolk clergyman, the landed proprietors in that part of the country now know that these long neglected pebbles may be exchanged for gold. They can hardly have received up to this time less than one million pounds sterling as rent or royalty for coprolite digging. And this exchange of stones for gold on the one hand, and on the other the conversion of these stones into bread, may be carried hereafter to an extent which no one can foresee, and reach an importance which, as the population of the world augments, we can hardly in this day appreciate.

Now, contributions of importance to geographical science can rarely be made except under conditions which involve large pecuniary outlay and great personal risk. In astronomy, original observations require costly instruments, and days and nights of continuous and laborious watching. Even in chemistry, little can be done as respects orignal research, whithout a laboratory furnished with appliances of a more or less costly nature. But there are no such difficulties in the path of the naturalist. In whatever part of the world he may be located, and whatever may be his profession or calling, if he have but some knowledge of the rocks, minerals, and fossils which make up the crust of the earth, and of the forms of life which dwell upon the surface of that crust, he can hardly fail to turn that knowledge in some way to account; and while he indulges his own intellectual taste, contribute at the same time to build up the great storehouse of human knowledge. And on this ground, I conceive natural history may very justly rest as one among many reasons that favour its being taught in schools, and so far as first principles are concerned, taking its place with geography and astronomy in that curriculum of study which we all expect our well educated youth of both sexes to pass through.—*Edward Charlesworth, on Natural History as an Element in School Teaching.*

THE EMPIRE UNDER COMPETENT AGRICULTURAL DIRECTION.

NOW that the Supreme Government have seen fit to put a greater amount of responsibility on the local Government, and decentralization is recognised as advisable, we hope that innovations which before were impossible, may, at last, stand some chance of success. It is becoming more and more evident every day that irrigation, as the only panacea to keep up the fertility of the soil, is declining in favour in the minds of those who have the welfare of the country at heart. And while it is probable that the works of the Forest Department will assume dimensions that until recently were never dreamed of, we think their energies should be largely controlled by the agricultural demands of the country, and for this purpose trained agriculturists must unite their counsels with those of the irrigation and forest departments. Large irrigation works have hitherto been constructed solely for their probable value in an engineering point of view, and have resulted in many cases in lamentable failure, because the agricultural side of the question has received no consideration. The ryot has been taken as a unit unworthy of calculation, and his probable wants rather than his actual requirements have been wildly guessed at, and the works undertaken on erroneous assumptions. Nor have the peculiarities of the land received that attention they should. Thousands of acres have been rendered permanently unfertile by our too complete irrigation works when a few rupees forwarded to an analysing chemist would have furnished the Government with facts that would have saved lakhs of rupees. And further, the brains both of the chemist and the agriculturist have been ignored for a rule-of-thumb that nowhere but in India would pass unnoticed. The engineer has rendered square miles of country capable of irrigation, but no pains have been taken to make an analysis of the water, so that we might know its manurial properties and estimate its value as plant food. Water whether it be rich or poor in quality is only water in the eyes of the engineer. Again, it has been pre-supposed that the enormous amount of this fluid the ryot consumes is essential to all growth of the rice-plant, and because it has been the business of no department to prove the contrary we have constructed irrigation works many times as expensive as necessary. To go a step further, we have even adopted the native idea that paddy-cultivation is the perfection of farming, and every drop of water that can be collected in a reservoir for the purpose of irrigation is being put to its best use.

It is only quite recently a few voices have been raised in mild protest against these ideas, but we are glad to say, small as they have been, and few in number, they are now recognised as more than the absurd utterances of idealists. We would even go so far as to say that a suggestion we are about to place before our readers will be read with interest. It has been the custom, as we have already noticed, to look at irrigation only from an engineering point of view, and now there is a chance of this ceasing, and forest conservancy assuming large dimensions. In our opinion, both these departments should

work a large number of their schemes for ameliorating the condition of the country conjointly with an agricultural department—we do not mean the Revenue, Commerce and Agricultural Departments we have, but one composed of men who really do know something of the subject. We should like to see if, for instance, it be determined to improve a collectorate, an agricultural survey, and report submitted in the first instance, exhaustive in its nature, and containing suggestions how a given sum allotted for agricultural improvements could be best distributed. The probabilities of increasing the flow of springs by tree-planting should be dealt with, and also the requirements of the country for cloud-detaining topes, and for trees for a supply of manure and fuel. The forest officer having thus a broad idea to work on, would, in his turn, traverse the country, ascertain the most suitable trees for certain soils, and for local requirements; or, in the event of large areas for reserved tracts, the selection of those varieties which would, in course of years, become of the greatest value to Government. The agriculturist having mapped the country with a view to amelioration by tree-planting, preservation of certain lands for pastures, and the production on the spot of a supply of organic manure for future generations of crops, and the forest officer having his work set out, the engineer might then be in a position to plan and carry out the works of his craft suitably to the condition under which the country might reasonably be assumed to acquire tree-planting by retaining the moisture in the land and enabling the ryot in time to devote his cattle-dung to its legitimate object, manuring his fields, would render the enormous works to resist drought and famine in many cases superfluous, and over large areas instead of the shallow evaporating basins we call, by courtesy, tanks, a curtailed water-supply in the form of small deep tanks and wells might be sufficient.

It is true paddy-cultivation would be curtailed, but which is better—to increase the sanitary condition of the country by the abolition of this, and also enhance the yield and the certainty of crop over the vast area of land devoted to dry cultivation by securing, with the aid of manure, an amount of water in the soil they would tide over any ordinary dry period; or go on as we are doing now, spending enormous sums in rarely remunerative works which are liable, after a time, to become useless by the accumulation of their own silt? Unless the agriculturist is the motive power in a scheme of this sort, we fear the forest officer will forget the agricultural demands of his attention, and devote too much time and money in perfecting forests where they grow best. His work, like the engineer's, is apt to run in a groove, but with agricultural requirements held steadily in view, both can aid in the grand work of ameliorating the condition of the country by cordial co-operation, and achieve results by united action that would otherwise be impossible. We do not wish to absorb the whole time of an engineer in agricultural works; roads must be attended to, and buildings constructed; neither would we wish a forest department wholly to ignore the necessity for directly remunerative forest conservancy. Still, we believe, officers of both departments would do far more general good to the country if they worked in unison and were associated intimately with that at present almost specimen individual—the Indian agricultural officer.—*Madras Times.*

THE SUGAR MAPLE.

[*By Mr. G. Maw, published in the "Gardeners' Chronicle."*]

ACER saccharinum is a much larger tree than the red maple and is at once distinguishable from it by the roundness of the notch between the lobes of the leaves. It is one of the largest trees of the genus, often attaining a diameter of from three to four feet, and out-topping the other deciduous trees, sometimes reaching a height of over 100 feet. For fuel and charcoal its wood is especially valuable; it also produces the well-known bird's eye maple wood used in cabinet work, supposed by Emerson to be a distinct variety of sugar maple, but from information given me in Upper Canada, it seems probable that it is only of mere casual occurrence in individual trees. This species is pre-eminently the source of maple sugar, and was known to the Indians before the settlement of the country by Europeans.

I had the advantage of inspecting on the farm of a Dutch gentleman, near Haysville, a section of the forest in which the maples are tapped, and the collected sap boiled down for sugar, the particulars of which I record.

A very interesting physiological point, connected with the production of maple sugar, is the variability of the flow of the sap dependent on diurnal changes of weather, the whole life-force of the big old trees being apparently ruled by trifling changes of temperature and alternations of heat and frost. Changes of life-action occur which are unappreciable to the eye in the daily development of the spring growth, but which the flow of sap records with precision.

The rising of the sweet sap commences immediately after the first break-up of the long frost from the middle to the end of February, continuing through March and into the early days of April, but varying in different localities and at different seasons. A cold north-west with frosty nights and sunny days in alternation, tends to incite the flow, which is more abundant in the day than the night. It is, however, most sensitive to unfavourable changes, and from a flow of three gallons a day from one tree may almost cease in a few hours, and then gradually recover itself. From this it will be seen that the flow given from day to day is uncertain, and that reliable statistics of produce are difficult to record. A continuous course of favourable weather tends to the largest production, a rising and falling supply reducing the total produce of the season.

The time at which the flow commences varies not only with the season, but with the exposure and elevation of the ground, being earliest in warm and low situations. A thawing night is said to promote its flow, and it ceases during a south wind and at the approach of a storm, and so sensitive are the trees to aspect and climatal variations, that the flow of sap on the south and east sides has been noticed to be earlier than on the north and west sides of the same tree.

There are generally from ten to fifteen good "sap-days" in the sap season, which continues on and off for about six weeks, after which, as the foliage develops, the saccharine matter is reduced, and the sap is said to be "sour," though a restricted flow still continues. Emerson, in his work on the "Trees of Massachussets," referring to Michaux's observations, considers that the product of sugar depends also on the character of the previous summer, and that a season of plentiful rain and sunshine prepares the tree for an abundant harvest of sugar in the succeeding spring. Open winters are thought to cause the sap to be sweetest, and much freezing and thawing to make it most abundant and of the best quality. The sap of isolated trees is richer in sugar than that of those which are massed together in the forest.

In the maple bush at Haysville the produce of sugar was at the rate of 1 lb. to each 6 gallons of sap, and the average may be 1 lb. to 4½ or 5 gallons, but Emerson records instances in which 1 lb. of sugar has been produced from 3 gallons of sap. With reference to the produce of individual trees in a good sap season, an average tree will run as much as 3 gallons of sap in a day, occasionally more, and produce about 4 lbs. of sugar in the season, but Emerson records instances of the production of 10, 20, 33, and 43 lbs. of sugar from single trees. Such weights are, however, altogether exceptional. The highest weight was produced from a draught of 175 gallons of sap from a single tree. The average quantity per tree would be from 12 to 24 gallons in a season.

Young trees under 25 years old are seldom tapped, the smaller trees scarcely paying for the trouble, apart from the debility it produces in the young growing tree. Repeated tapping of the matured trees produces no apparent injury or effect on their vigour. Emerson records instances of trees that have been tapped 40 consecutive years without injury, and it is said that both the quality and quantity of the sap are visibly improved after the first tapping.

The trees are usually tapped at the height of 3 ft. or 4 ft. from the ground, with a ¾-inch auger, to the depth of from 2 inches to 6 inches, into which a perforated plug is driven to lead the sap into the collecting vessels, or a simple notch, 1½ inches deep, is cut with the axe. From one to three taps are inserted in each tree, and these have to be renewed in succeeding years in fresh places, generally alternated on opposite sides of the tree. The sap is evaporated either in iron chaldrons or in shallow boilers, 6 feet long, 2½ feet wide, and about 8 inches deep. Those of copper are preferred to iron, as they are said to yield a whiter sugar.

Care is taken to keep the boilers filled up with fresh additions of sap during evaporation till the syrup attains a sufficient consistency, which is ascertained by its "breaking" or crystallizing when dropped into cold water. The syrup is strained during evaporation, a small quantity of lime or soda added to neutralise any free acids that may be present, and a little white of egg or milk to clear it. After straining and skimming, the syrup is poured into pans or moulds to crystallize, and it may be further clarified by gently boiling in tapering cans with a tap at the bottom, towards which the molasses gravitates, and is drawn off as the crystallized sugar sets.

A considerable proportion of the maple sap product is also preserved as syrup without crystallization, and in this state it is used as sweet sauce and for various culinary purposes.

Maple sugar is made not so much as an article of commerce as for the home use of the producers, and the great bulk being consumed where it is made, it is difficult to arrive at anything like an accurate estimate of the total production. Emerson states that in Massachussets alone between 500,000 and 600,000 lbs. weight of sugar are annually produced from the maple, and he values it at 8 cents. a lb. In 1874 the price rose to from 10 to 22 cents. a lb. In Canada at the beginning of April last, new maple sugar was selling at from 10 to 11 cents. a lb., about the price of the best cane sugar.

The maple sugar production is said to be a growing industry and if the preparation could be centred in well-ordered factories, on the plan of the cheese and butter factories, there is little doubt that carefully-prepared maple sugar would closely compete in price with cane sugar. As it is, with the simple and almost rude appliances for preparation, there is little to choose between the purchase of cane sugar and the cost of producing the local home-made sugar from the sap of the maple.

THE 'TRANSACTIONS' OF THE HIGHLAND SOCIETY.

THIS annual publication has been issued a little later than usual. If there is not as much original matter in the present volume as in some former issues of the 'Transactions,' there is at least no lack of variety. No 'county report' appears this year, but the volume will be none the less useful to members on that account. The short reports of various sorts of experiments on the farm, published this year by the society, are of more service to agriculture than the county reports have ever, or at any rate latterly, been. About one-third of the matter specially prepared for the 'Transactions,' consist of a very interesting and carefully prepared 'Historical Account of the Veterinary Department of the Highland and Agricultural Society.' This exhaustive and well-written description of a highly serviceable department, which began about 1828, and as our readers know is to cease in 1881, was prepared by the society's painstaking and accurate officials, and does credit to the secretary's office.

The place of honour is not unworthily bestowed on the 25 sovereign essay on the 'History of Leases of Lands from the Earliest Times,' written by Mr. M'Culloch, Denbie Mains, Lockerbie. The author's views on leases should not be new to our readers, so that we need not quote extensively from the present report; but we have pleasure in recommending perusal of the clearly written interesting pages before us. Towards the close Mr. M'Culloch advocates greater freedom for the tenants than present leases and customs allow, as also more security for outlay; and in regard to game he says:—

'Game has perhaps more than anything else caused ill-feeling and litigation between landlord and tenant; and as yet no adequate remedy has been afforded by legislation. The Game Bill of 1877 is bad in principle, for it first allows the damage to be done, and a claim for compensation is almost certain to cause annoyance, repeated litigation, and in the end insufficient remuneration. Mutual rights to the game seem the only satisfactory settlement, and, as regards its working, the writer is assured by a landlord of considerable experience, that the discharge of his gamekeepers and trusting his tenants instead, resulted in as good sport and the cementing of better relations between them.'

The familiar and ever-attractive pen of Mr. Hutchison, of Carlowrie, has furnished two useful papers to this volume. They are, as usual, on arboricultural subjects. The one on 'The old and remarkable Spanish Chestnuts in Scotland,' cannot fail to be specially interesting reading to a large number of the society's members.

Mr. John Ainslie, jun., Hillend, near Edinburgh, deserves that medium gold medal awarded to his report on manuring experiments, short as it is. Experiments and reports of this sort should have every encouragement from the society. Mr. Ainslie commenced in 1875 to test carefully the comparative advantages of ploughing in at once dung applied to the stubble in the fall of the year, and leaving it spread on the surface seven or eight weeks. Potatoes formed the first crop after this manuring; and he found that the produce of the part on which the dung lay eight weeks exposed yielded £1 8s. 6d. more per acre than was netted from the part of the field in which the dung was ploughed down within a week. The succeeding crop of wheat showed a balance of 5s. 8d. per acre in favour of leaving dung exposed. On turnip crop that followed, however, there was no visible difference. Mr. Ainslie, as well as his father, is a keen advocate of the system of leaving dung spread on the land for several weeks before it is ploughed in, but he strongly disapproves of letting it 'lie in heaps for weeks.' It should be spread shortly after it is carted to the field.

Professor Tanner, writing on 'Variations in the Composition of Oats,' gives some curious statistics, showing the great variety in the food-producing capabilities of different soils and climates even within the United Kingdom. He also indicates the marked advantage of using strong, well selected seed. Mr. George Grant, Allanichie, Dufftown, received five sovereigns for a concisely written description of the means by which he reclaimed 10 acres of waste land a few years ago. The reclaimed ground is 800 feet above sea level, with a northern exposure, and was formerly mostly under heather. The soil was a mixture of clay and granite, with a clay sub-soil. It was first drained 3 feet deep, 21 yards apart, at a cost of £6 3s. 9d. per imperial acre. The land was then ploughed to a depth of about 7 inches, with a team of three horses, which operation cost about £4 10s. per acre. Two acres were ploughed in the summer of 1869, and the remainder in the following season; 18s. worth of lime per acre was spread on the surface about the time the oats were sown in the spring of 1871, and 2½ cwt. per acre of Peruvian guano were applied. The crop was much better on the two acres first ploughed than on the rest. By the way, 8 bushels of seed were allowed per acre. The first crop yielded, as did the second, about 4 qrs. per imperial acre. After two oat crops a good crop of turnips was grown, and the land was afterwards sown out with an oat crop, and has since been pastured with cattle. From the tabulated statement of income and expenditure, Mr. Grant shows a net profit from his labours during the last eight years of £36 3s. Mr. John Scott, London, contributes a valuable, though short, paper on 'Animal Parasites,' for which he merits and receives a premium of ten sovereigns. Mr. John M. Aitken, Edinburgh, writes on *Hylobius Abietis* or Fir Weevil; while Mr. William Sisling, Nottinghamshire, furnishes an instructive paper on 'The Growth and Cultivation of Willows in Scotland.' The 'Cause of Ringshake in Trees' is intelligently treated of by Mr. Thomas Wilkie, forester, Ardkinglass, Inverary.

By no means the least interesting of useful contribution to the volume is a well-arranged paper by Mr. Thomas Lawson, Sandyford, Kirriemuir, detailing the results of experiments made by him with 'lime and various artificial manures.' To this paper we propose to return at an early date. Last but certainly not least in importance comes Dr. Aitken's report on the Experimental Stations commenced by the Society last May in the Lothians. Owing to the severity of the past winter, and the fact that the long frost had set in before it was expedient to lift the crops upon the several stations, a complete and detailed report of the first season's experiments has had to be withheld. These experiments have been undertaken for the purpose of determining the crop-producing value of the various forms of the most important manures. At each station there are 10 acres under experiment, divided into 40 plots of one rood each. The manures on each plot contain 40lbs. phosphoric acid, 30lbs. potash, and 10lbs. nitrogen. The higher priced dissolved phosphates have been tested in regard as well to their remote as to their immediate action. The difficulties presented by diversity of soil and climate are in the report fully recognised; and the pains which have been taken to avoid hasty conclusions are greatly in favour of the experiments. Speaking of this somewhat perplexing diversity and its effects on field experiments, Dr. Aitken says,—'It would be a great advantage to agriculture, and would immensely enhance the value of the experiments being carried on at these society's stations, if farmers in different parts of the country, who have time and aptitude for that kind of work, would repeat, upon their own lands, any of the sets of experiments described in the accompanying scheme. I would be glad to give to those who would do so any aid in my power.'

The two stations secured for the society's experiments consist of land very different in character and origin, and are described as 'fairly representative of a large part of the arable land of the Lothians.' On Harelaw (Longniddry) the soil is a deep loam, overlying limestone, situated near the sea, exposed on every side, and possessing a fine natural drainage; and is, moreover, one of the earliest districts in Scotland. The Pumpherston station overlies the carboniferous formation, is a thin boulder clay, situated upwards of 300 feet above sea level, and is in a colder, damper, and later district. Acting on the belief that the plots should be as large as possible without being too large, the size chosen has been a quarter of an acre. All the plots are about 400 feet long, with a breadth of 28½ feet, and (as shown by diagrams appended to the report) are so arranged as to give a clear run for the plough of about 800 feet. Experience has served to demonstrate the disadvantage of having a station (all under one crop) so large that it could not be shown in one day. This was found to have been a drawback at both stations. Wet weather at Harelaw caused an interruption of nearly a fortnight in sowing. The varieties of soil, even in one rood, were strikingly exemplified at Pumpherston, and differences in the crop appeared to be traceable to this cause. Indeed, one plot (No. 36) of the Pumpherston station, was so unequal in its soil that it has been deemed advisable to reject it altogether. A chart accompanying the diagrams already mentioned, shows the system of cultivation to be a four years' rotation of turnips, barley, and grass. It deserves to be noted that those crops to which farmyard manure had been applied, suffered greater injury during the severe winter than did the crops which were manured only with artificial manures.

At Pumpherston, the crop was turnips (Fosterton hybrid); and the manure, which had been duly analysed and carefully applied, were protected against wind after the Rothamsted method, by the use of large canvas screens carried alongside the sower, though by this means the outermost drills of some plots received more than their due share of manure,—a circumstance which told on the crop, especially where very light manures were employed. The main facts deduced from both the experiments are briefly summarized as follows:—

'*Phosphate Plots.*—It will be seen from the chart that the first ten plots received each an amount of phosphate containing forty pounds of phosphoric acid. The odd numbers received undissolved phosphate, and the even numbers dissolved phosphate. It was noticed that the plots under dissolved phosphates took the start of the others, and their tops first met in the drills. Thereafter, the differences between the odd and even plots became less and less. When the bulbs were formed the same difference was apparent in them, but it was not so pronounced as one would have been led to expect from the appearance of the leaf. At Harelaw, scarcely any difference could be detected in the size and appearance of the bulbs of these ten plots. Plot 11, however, which received no phosphates, looked very poor, and Plot 12, which received bone-ash alone, even poorer. Plot 5 (bone-dust) and Plot 6 (bone-dust dissolved) were backward at first, but improved considerably towards the end of the season. The plots with mineral phosphates looked quite as well as those with animal phosphates.

'*Nitrogenous Manures.*—No difference was noticeable between Plots 13 (nitrate of soda) and 14 (sulphate of ammonia). The shoddy plot (15) was a very poor one, though it began to improve just at the end of the season. Plot 16 (dried blood) was slow to begin, but it improved very rapidly, and in the end looked better in leaf than the others. Plot 17 (no nitrogen) was a decided failure, especially at Pumpherston, and Plot 18 (nitrate alone) was dark-coloured in the leaf, and came away pretty well at first, but it improved very slowly, and remained very backward.

'*Potassic Manures.*—The sulphate of potash plot looked better than the muriate plot all through the season, but the difference was not great. The

want of potash did not seem to retard the growth so much as one would have expected, considering the large amount of potash which is found in the ash of turnips. Still more unexpected was the appearance of Plot 21, which received sulphate of potash alone. It did not even look so well as the unmanured plots on either of the stations.

'*Guanos* (23-26).—The plots on which these manures were sown were all somewhat backward, especially that with fish guano.

'*Superphosphates* (28-30).—The difference between these plots was trifling. What difference did exist was in favour of Plot 19, which had received the medium amount of soluble phosphate

'*Various Quantities* (31-34).—There was no doubt possible regarding the influence of the manures on these plots. The greater the amount of manure the better seemed the crop. Plot 32, however, was an exception on both stations.

'*Rape Cake and Cotton Cake* (35.)—The half plot with rape cake was decidedly better than the other with cotton cake.

'All these rood plots had the same amount of phosphoric acid, potash, and nitrogen applied to them, except Plots 11 and 12, 17 and 18, 21 and 22, which received a partial manure, and Plot 27, which remained unmanured.

'*Miniature Plots* (36).—Upon the whole, these plots agreed very nearly with the large ones, of which they were duplicates. This, however, applies only to the Harelaw station. The Pumpherston series, as before remarked, is valueless, on account of the inequalities of the soil.'

Before concluding his very interesting report, Dr. Aitken is at pains to point out that, as appearances are often deceptive, too much reliance ought not to be placed on comparisons between the various plots, as that which has the best leaf may not produce the best bulbs, and the large bulbs may not in the end weigh out so well as others. It is also noted that at Harelaw several minor experiments took place. In one of these we are told that :—

'A quantity of seed was divided into three portions, according to their specific gravity. For this purpose the seed was put into a glass cylinder, and water poured upon it. About a fourth rose to the surface, after being well agitated to rid them of air bubbles ; this was taken as light seed. Salt water was then added, till the half of the remaining seed rose to the surface ; this was taken off as medium seed, and the portion at the bottom constituted the heavy seed. The two latter portions were washed to rid them of brine, and all were spread on cloth overnight to dry. Next morning they were sown. The heavy seed sent up a braird of great strength and quantity, the light seed gave a poor sparse braird, and the medium seed was intermediate. They were all thinned at the same time, the light seeds scarcely requiring any thinning. To my great surprise, on inspecting these a fortnight later, the light seed drills were the best, the heavy ones the worst, and the others intermediate, and this position was maintained during all the growing season. The reason of this was not difficult to find. Of the heavy seed nearly every seed grew, and of course a great struggle took place for the food contained in the soil, and they were not able to make such good root as the few living seeds among the light portion, and what roots they did make were much disturbed in thinning out their closely-packed neighbours. This experiment shows the evil of thick sowing. It is to be noted, however, that there was no appearance of turnip fly. Had that pest appeared, there would probably have been no crop at all from the light seed.

'Samples of 40 carefully selected turnips were taken from each of the plots at Pumpherston before the frost set in—that is to say, about four months ago—and a large proportion of these have been analyzed, and afford results which will be interesting and instructive when taken in connection with the full report of the cropping at both stations ; but to make any observations on them in their present state would be premature, and might even be misleading.—*N. B. Agriculturist.*

THE GARDEN.

EVERY resident in the country, with an eye for plants, must be familiar with the circular black spots on leaves of the sycamore and maple. According to M. Max Cornu, as quoted in the last number of *Grevillea*, these spots are the work of a parasitic fungus sometimes called *Xyloma acerinum*. This Xyloma is, however, only a transitory form of the fungus, for when the leaves fall to the ground in the autumn a new growth appears in these spots, the plant produces asci, and becomes *Rhytisma acerinum*. The parasite is annual in its duration, and is altogether confined to the deciduous foliaceous organs ; it is only fully developed on the organ when they are in a young state. In order to destroy the fungus it is enough to remove all the spotted leaves which fall in autumn.—*Gardener's Chronicle.*

THE VICTORIA REGIA.

A MOST interesting experiment in acclimatisation has lately been successfully carried out by Mr. Sowerby, the Secretary to the Royal Botanic Society, who conceived the idea of transplanting to equatorial Africa one of the most remarkable specimens of the flora of the American continent, viz., the gigantic water lily, the largest and most beautiful of known water plants, named, in honour of the Queen, Victoria Regia. This magnificent plant was discovered about forty years ago by Sir R. Schomburgh, whose explorations in Guiana and the neighbouring countries in the northern portions of South America, threw so much light on these then little known lands. It grows abundantly in the warm waters of the Amazon, where it attains a size, the mere mention of which would have sufficed to place it at once in the category of "travellers' wonders," had not the scientific and energetic explorer been fortunate enough to bring home living proofs of his assertions. Splendid plants have been grown from seeds at the Royal Botanic Gardens at Kew, and elsewhere, though, of course, not equaling the lily in its native waters, were its great round leaves cover an enormous area. Having been reproduced under artificial heat, in warm water—and once even in the open air—in this country, the flower has travelled to Central Africa. Seeds grown in London were first sent to Zanzibar, where they produced plants which now adorn the gardens of Seyyid Barghash, and more lately they have been carried to Lake Nyanza, where it is confidently anticipated that they will find a congenial home. Though some 6,000 miles distant from the Amazon, this lake, is in the same latitude, and the whole system of lakes and rivers in Central Africa may eventually find a new ornament in a water plant peculiar to the New World, having first halted on its migration, so to speak, in London. Some seeds have also been taken out to China by the late Chinese Ambassador, and as Mr. Sowerby's experiments have proved the best way of transporting the seeds, this plant will no doubt, as he says, soon be "naturalised in the remotest corners of the globe." The seeds resembled in shape and size black pigeon peas, and if kept in water in the light they will remain alive a year or more without sprouting. If placed, however, in darkness and at a moderate temperature they begin to grow, so that the task of safely carrying them throughout a long and tedious journey like that to China or Lake Nyanza is one requiring no slight attention.—*Globe.*

PRACTICAL HINTS ON FLOWER GARDENING IN MADRAS.

A GARDEN to be a pleasure should be always neat and tidy. Nothing looks more untidy than decaying leaves and flowers, and, as a matter of fact, nothing tends to keep plants longer in flower, than picking off all old flowers and not allowing plants to bear seed. If any seeds are wanted they should be grown on one or two plants, selected and planted out of the way somewhere. It is seed-bearing which wears out plants and makes them look dried up and unsightly. But besides this a great thing in a garden is to have a constant succession of flowering plants. If a plant gets withered and past its work ; or if the season for one description of flowering plant is over, a great matter is to have another kind ready to put in its place. One of the great beauties of a good English garden is the constant succession of flowers. First, in the spring, bulbous flowers, crocus, tulip, hyacinth and the like. On some warm morning in May the garden appears transformed. The bulbs are all gone and the beds, as if by magic, in a night are filled with flowering geraniums, foliage plants and midsummer flowers. Again, later in August, the same transformation takes place, and dahlias, chrysanthanums and the "last rose of summer" suddenly bloom in the parterre. This change is managed by having the plants ready in pots. A great deal can be done in India in the same way, if not by completely changing the bed, yet at all events in freshening up and renewing plants, where they have died or become old and withered. Very fair flower pots are made at Madras, but they are not so good as those in some parts of the Mofussil. One reason flower pots often fail in Madras is, that garden owners buy them in the wet season, and even order them at that period. The consequence is they are burnt without being thoroughly dry, and are easily made rotten by constant watering. A well-burnt pot will last a long time. Whenever and wherever they are obtained, care should be taken not to buy pots with too small a circumference at the bottom. Some flower pots in Madras have been lately made which are as large and round below as above. This is wasteful of soil and wasteful of space. The surface roots of plants want more room than those below. Besides, if this plan was adopted for small pots, there would be a difficulty in getting the plants out with the earth attached to them when moving them. It is, of course, impossible to say what flower-pots a person may require for his garden, but for the purpose of keeping a stock of flowering plants ready to fill up vacancies, the best size are pots about six inches in diameter at the top or mouth. Lateral drain holes are better than holes at the bottom. When flower pots drain in the latter method the roots of all sorts of plants find their way through and get into the ground under the pot. It is well, before potting commences, to have two heaps of broken bricks or tiles ready. One heap containing pieces about as large as small limes—the other composed of smaller pieces about the size of filberts. Bamboo sieves can be made by any mat-makers for about two annas each with meshes of any size fancied. After the bricks, of tiles, or whatever is used for drainage, are broken up, two heaps of uniform sized pieces can be easily obtained by sifting the broken stuff, first through the large sieve, and then through the smaller one. Supposing then the pots to be ready and the broken pieces of bricks and some compost and, silver

[illegible] as before mentioned, at hand. Let us consider how to proceed to transplant into pots a lot of balsam seedlings; it is assumed the balsam seed has been sown some time before in a large pot, and that the young plants have got about four leaves. Commence by filling a dozen flower pots. First, put into the bottom of each pot a handful of broken bricks, from the large heap, than a handful from the smaller heap —care being taken to put in enough to cover the drainage holes, if they are at the side. Give the flower pot a shake, so as to settle the broken pieces together. Then, having mixed the sand and mould, fill each pot with the mixture to the brim. After doing this, give the pot another shake. Just as tea dealers may be seen shaking the tea into papers to make it settle; this will bring the soil a little below the surface of the flower pot, as it should be, to allow of proper watering. After the flower pots are all thus filled, take a flat piece of bamboo which has been cut into the shape of a table knife blade, and with it carefully take up and put into each pot, one or more of the flower seedlings from the pot in which they are growing; keep these thus transplanted, in a cool place out of the sun, and out of any draft and without much water for a few days. By this plan a constant supply of young plants of every kind may be kept without much trouble, and at little expense. All sorts of young seedlings may be treated in this manner, and almost all kinds of seeds may be sown, at all seasons to procure seedlings. If those seedlings were put at once out into a bed, they would not resist the heat of the present season for a day, and will not do half as well at any season as they would do if brought forward, to about a dozen leaves in pots. The natives of India are very quick at learning all the manual part of gardening. They will learn to pot many dozen seedlings in a morning, and, what is better, will learn to move plants either from one pot to a large one, or into a bed without breaking the ball formed in the pot or throwing the plants back a day. Native gardeners may be taught everything, but judgment. The same plan of potting plants should be adopted in moving larger plants. Sometimes it is as well to have two men. If the plant is a large one, let one man put the palms of his hands on the soil of the pot, one palm on each side of the stem of the plants. The other man should then turn the plant over on to the palms of the hands of the first man and lift the pot off. The plant will then remain, but upside down, in the first man's hands, the ball of earth that has come out of the pot, being probably full of roots, and crowned on the top with the brick rubbish that had been put in the first instance into the flower pot, to drain it. Pick this brick rubbish off, and then slowly turn the plant round into the hand of the man who removed the pot, who should put it into the fresh pot destined for it, or into the bed as desired. By this means the plants never stop growing. They will always be healthy and will be strong to resist the attacks of insects and the change in the weather. After potting any plants keep them in complete shade for twenty-four hours, then put them out where they can get the morning sun. And in a day or two, if they are hardy plants, and the season is favourable, put them in the open, so as to get hardened. Do not give much water to potted seedlings, until they seem to be growing well. Then, and especially if in the opening, they should be watered freely every evening, as plants in pots get very dry in a short time. Sometimes large shrubs in pots are as well if not moved. Their roots have got through the bottoms of the pot into the grounds, and it would throw them back very much to move them. They will be much benefitted, if all the soil round the edge of the pot they are growing in, is removed. Cut away as deeply as you can a little ditch of the width of an ordinary garden trowel. As a rule, the soil in the pot will be so full of fine roots, that there will be no difficulty in cutting as narrow a ditch all round the inside of the pot as you wish. The fine roots will keep up the soil. Throw away all this earth that you have dug out. It will be completely exhausted of all nutritious qualities for the plants and in place of it put in a mixture of the best stuff you can afford, bone dust, if you have it, and compost mixed or else compost alone or even common red earth. Anything to give the roots a change of food that they may send some sap to the branches and leaves. Large crotons and shrubs treated thus twice a year will well repay the trouble.—*Madras Times.*

ECONOMIC USES OF THE PLANTAIN.

At a meeting of the Paris Academy of Sciences, on January 7th, Messrs. V. Marcans and A. Muntz briefly drew attention to the composition of the plantain and some experiments as to the utilisation of its fruit. It is strange, considering the abundance and cheapness of the plantain, which in many localities is suffered to perish from its abundance, how little has been as yet done commercially with it.

We have repeatedly drawn attention to its various products, among others in our work on "The Commercial Products of the Vegetable Kingdom," in different volumes of *The Technologist*, a in and recent work on "Tropical Agriculture." It may, however, be well to bring together some few of these published details, in order to amplify the very brief note of Messrs. Marcans and Muntz, which we will give first. These gentlemen state:—"The fruit of the plantain, or banana, is one of the food products most widely distributed in equatorial regions. Boussingault observes in his "Rural Economy," that the plantain forms the common nourishment of the people in warm regions. Between the tropics its culture is as important as that of the cereals and tuberous food plants in the temperate zone.

"In Venezuela, the plantation continues to spread more and more widely, and the population can consume but a very small portion of the fruit produced; hence attempts have been made to utilise some of the products for export. The last Paris Exhibition showed some steps taken in this direction, among others, plantain meal, obtained by drying and pulverising the fruit, gathered before fully ripe, and spirit obtained by distilling the ripe fruit after it had commenced alcoholic fermentation.

"This plantain spirit, after the first distillation, has a pleasant odour and an agreeable taste, marking 53° of the alcoholometer. The fruit, as it is received in bunches at Paris, perfectly ripe, and in a good state of preservation, will undergo the alcoholic fermentation if left to itself.

"The following is an analysis of the plantain as grown in Venezuela:—

"100 parts of fruit consist of 40 of skin or peel, and 60 of pulp. The skin contains 14·7 per cent. of dry matter, and 1·6 of interverted sugar; 100 parts of the pulp contain 73·8 of water, besides 8·5 of cane sugar, 6·4 of interverted sugar, and the remainder is made up of starch and other substances.

"The proportion of sugar is considerable in the ripe fruit, although the cane sugar cannot be profitably extracted, it is considered that it might be utilised for the production of spirit.

"At the time of Boussingault's travel's, the price of plantains was but a franc the 100 kilogrammes, and this weight would yield 9 litres of alcohol of 96o strength. The cost in many localities is now merely the trouble of collecting. Hence plantain spirit may possibly compete with that made from the refuses of the sugar cane."

Humboldt calculated that the same extent of ground, when cultivated with the plantain, will support a far greater number of people than when planted with wheat. The yield has, however, been found to differ with the mean temperature of the place. Boussingault has given the following as the produce per imperial acre of the raw fruit in three places:

	Temp.		Produce per acre. Tons.		Dry Food per acre. Tons.
Warm regions ...	81½°	...	72	...	19½
At Canca ...	78½°	...	59	...	16
At the Hague ...	71½°	...	25	...	6½

Professor Johnston is the authority for the last column, or that of dry food per acre, as he had, from his analysis, obtained 27 per cent. of nutritive matter from the banana.

The extraordinary accounts which have from time to time been published with regard to what a plantain walk was thought to yield, have failed to attract capital to this branch of agriculture. These calculations were not always extravagant, some have been sober enough, and yet they showed considerable returns. Several tons of plantain flour, besides one and a-half tons of fibre, can be obtained per acre, and the outlay for tillage and machinery is small.

The plantain is gathered at three different stages. At a fourth part of its maturity it is rather milky and contains much starch. If it is roasted in ashes or boiled in water it forms a very nourishing food, capable of being substituted for bread. When cut at three-fourths of its growth, it is less nourishing, but contains more sugar; in this state it is eaten as an accompaniment to meat. Lastly when the fruit is fully ripe, all the starch is changed into gum or sugar; it then develops an acid principle; it is eaten either raw or in the form of fritters. The banana, the other edible species, which is only eaten when perfectly ripe, is rather a fruit than a nutritive food; it is soft, full of sugar, melting, and possesses a powerful perfume, and forms a principal dish for dessert in tropical regions. In those countries they cut them while still green, and hang the bunches in their houses to ripen.

To hasten their ripening in China they are covered with rice or even with lime. The Chinese also eat the flowers of the plant pickled in vinegar. The plantain, when plucked ripe, keeps fresh for about a week; at the end of that time it becomes yellowish and more sugary; in twelve or fifteen days it begins to decompose and ferment. In South and Central America there are two methods of preserving the plantain for food; the first, used when the fruit is green, produces plantain meal, the other, when the fruit is completely ripe, produces the *platano pasado* of the Mexicans or the *platano curado* of New Granada.

Mr. W. W. Anderson, in an article in my journal, *The Technologist*, in 1867, thus spoke of the flour of the plantain. "This is well known in many parts of the West Indies under the name of 'Conquintay,' and is highly esteemed and extensively used as a food for invalids and children. It is decidedly superior in these respects to arrowroot, in consequence of its nourishing and strengthening qualities. It may also be stated that it is curative of diarrhœa and similar bowel complaints in consequence of the tannin which it contains. It is hardly known in Europe, where, however, we believe it would be greatly prized, and would supersede the patent groats, patent pearl barley and similar preparations. The plantain for flour must be cut, not only before it is ripe, but a little before it is what is called 'full.' It should not, in any of the processes to which it is to be subject, come in contact with iron or steel, which instantly imparts to it an inky black colour.

"It must be sliced with nickel or silver plate, or even bone or hard wood knives, and dried. The thin slices should be baked in an oven for eight hours, or dried in the sun for a couple of days, and then pounded in a wooden mill or mortar and cooked in a tinned or enamelled vessel. There is a pleasant soft fulness in the taste of cake or pottage of the plantain flour, which will always recommend it, in whichever of the forms above stated it is used except baking it into bread. Plantains from their bulk, cannot be transported from interior places in the green state, but

when made into flour the value will bear the charges of transportation, aye of exportation too.

"The starch drawn off from the green-grated plantain appeared to me unusually thick and clammy. I wish that some one better acquainted with the qualities on which the commercial value of the article to the manufacturers depends, would examine and report on it.

"The residue after the starch is separated, what I may call plantain tapioca, is a pink-coloured substance, which crumbles easily, and when cooked (always avoiding iron vessels) as is done with arrowroot and tapioca, and seasoned with sugar, it forms, with milk, a pleasant food of a delicate and agreeable flavour. But, besides being a good strengthening food for children and persons of sedentary habits, from its lightness and easiness of digestion, it would, I think, be a substantial food for labourers, especially Europeans.

"Plantain meal will no doubt acquire great importance in foreign countries when its nutritous properties, 5 per cent. of nitrogenous matter, become more generally known. The best way of procuring the farina fresh would be to import into Europe the dried slices and grind them."

This is a speculation which could not fail to be successful in the colonies seeing that a bunch of plantains, stripped of the skins, give at the least 50 per cent. of pulp; and the fresh pulp furnishes 40 per cent. of dry farina. The yield is usually about 8lbs. per bunch of a mean weight of 25lbs. An acre of plantains would give on the average 450 bunches, yielding 1,350 lbs. of meal. There is another method employed in South America, but it is defective in a great many points as compared with the dried slices. They grate the fruits, having first peeled them, squeeze the moisture out in a press and bake them, like manioc, in an oven, and by this means obtain a coarse kind of flour. But the nutritive property of this is inferior to that prepared from the dried slices, for no doubt the pressure which extracts the moisture, expels also the soluble albumen and other nutritious qualities.

The best method of preserving the banana very closely resembles that commonly used in the preparation of dried fruits, such as figs, prunes and raisins. The time chosen is when the fruit is quite ripe and its skin has become of a yellow colour, shaded with black. In the hot regions of Mexico the banana are dried simply by exposure to the atmosphere. They are laid in the sun in bundles, and when they begin to wrinkle they are peeled, the skin if left on causing a disagreeable flavour. They are kept for some time, until an efflorescence of sugar appears on their surface, as on dried figs and prunes. They are then pressed into masses of about 25 lbs. each and wrapped with leaves of the plant. There are three distinct ways in which the ripe banana may be dried :—

Firstly exposing the fruit to an atmosphere of sulphuric acid gas before the desiccation is begun. Secondly, boiling rapidly very ripe fruit in water which contains sulphate of lime. Thirdly, by boiling it in syrup. By either of these the albumen and casein of the fruit coagulates and the tendency of the banana to decay and ferment is stopped at a period favourable for desiccation. Experience shows that the second method is the best to employ; in moist climates, without this precaution, the fruit instead of drying becomes damp. To expose the fruit to the sun's rays after boiling, trays of bamboo, as in Mexico, or of anything which permits the free action of the air and light on the fruits, may be used. If rain falls they are dried in a furnace, which must be left open, otherwise the bananas bake instead of drying. The heat also must be moderate.

Probably Alden's fruit-dryers, a system adopted in the United States, might be found useful. Bananas, when pressed and packed in boxes, will keep perfectly good for any number of years. The fruit thus prepared is a very good article of food, resembling figs or dates, and its abundance and easy preparation would render it a cheap one. Many spirituous drinks, as well as vinegar, are made from the banana. Banana wine is obtained in Cayenne by pressing the fruit through a sieve and then making it into small cakes, which are dried in the sun or on hot cinders. When wanted for use they are dissolved in water. Another way is to boil the fruit, and passing them through a sieve to separate the skin; they are melted and bruised in the same water. From bananas soaked in brandy a liqueur is prepared which preserves the taste of the fruit; other liqueurs are also obtained by a process of fermentation.

FORESTRY.

THE *Builder* states that M. Lostal, a French railway contractor, recommends quicklime as a preservative for timber. He puts the sleepers into pits, and covers them with quicklime which is slowly slaked with water. Timber for mines must be left for eight days before it is completely impregnated. It becomes extremely hard and tough, and is said never to rot. Beech wood prepared in the same manner has been used in several ironworks for hammers and other tools, and is reputed to be as hard as iron, without losing the elasticity peculiar to it. According to the *Kurse Berichte*, lime slaked in a solution of chloride of calcium is used at Strasburg as a fireproof and weatherproof coating for wood.

THE Government of the United States seems to be arousing itself as to the necessity of putting some check upon the reckless destruction of timber which is going on all over their vast territory, wherever a settler or lumberman sets his foot. In his annual report to the President, Mr. Schurz, the Secretary of the Interior, devotes considerable space to the necessity of taking steps to insure the preservation of the forests. He expresses his opinion that the disastrous consequences which always follow the destruction of timber in a country will inevitably come upon the people of the United States in a comparatively short time, on account of the rapidity with which the timber growth of the country is being swept away, unless legislation steps in to arrest this indiscriminate destruction. He strongly renews his recommendation for the passing of a Bill, already introduced in Congress at his suggestion, which enacts that all timber lands, which are chiefly valuable for the timber upon them, shall be withdrawn from sale or any other alienation under existing laws, and shall continue to be held by the Government with a view to prevent the injudicious destruction of the timber, and to protect the growth of young trees.

WE learn from a recent Forest Report that the maple is assuming a very important place in the forests near Darjeeling, yielding as it does a very fair firewood, and being raised with the least amount of trouble. It will form in future the main stand-by in reproductive measures, the more valuable trees being planted here and there among the maple woods. There are now five acres under Spanish chestnut, but the results are not satisfactory, and it is not intended to send more seed of this kind to Bengal.

SOME interesting statistics relating to the area of forest land in France have been published in connection with the Agricultural Budget of that country, recently under discussion in the Chambers. From these it appears that at the present time France possesses 9,185,310 hectares of forest, representing a sixth part of the whole extent of territory. Of these 967,120 hectares belong to the State, 2,058,729 hectares to communes and departments, and 32,059 to public bodies or establishments. In former times the State owned a far larger extent of forest, which underwent a constant diminution between 1791 and 1872. From 1814 to 1830, under the Restoration, 168,826 hectares were alienated; from 1830 to 1848 the Monarchy of July got rid of a further 118,166 hectares; and finally, under the Second Empire, 71,930 hectares were lost between 1852 and 1870. The transference of Alsace and Lorraine to German hands brought with it a further diminution to the extent of 97,025 hectares, and the restitution of the property of the Orleans family involved a last surrender of 430,614 hectares more. Under the terms of the law passed in 1874, the State has bought since that date 10,000 hectares of mountain forest lands, but the produce of these and former possessions still retained is altogether insufficient to supply the demands of the home consumption. Of the 967,120 hectares now belonging to the State 130,929 are returned as absolutely unproductive. The remainder yield an annual income of 3,678,000 francs.—*Country Gentleman's Magazine.*

MANY of our readers are familiar with the large cabbage-like leaves of the robust *C. succirubra*. The coolies use them as substitutes for plates. We have seen a good many big *succirubra* leaves, but we think the specimen which reached us by post from Mr. Edward Thwaites of Hakgala Gardens is the largest yet. To the eye it looks almost round, and when measured it gave 16 inches from junction with stem to point and 12½ inches across the middle for breadth. As the breadth diminishes but slightly towards the point, we have here a superficies of nearly 200 inches, or over 1 square foot! In length, however, the first leaf of Liberian coffee sent to us by Mr. Charles Strachan, of Messrs. Carey, Strachan & Co., left this big leaf far behind,—the measurement for length being 21 inches, or only 3 inches short of 2 feet!—Mr. Thwaites tells us that the leaf of *C. succirubra* now forwarded by him was taken from a sucker of a tree cut down or coppiced last year.—*Ceylon Observer.*

As a proof of the humidity given to the atmosphere by trees, experiments show that the "Washington Elm," at Cambridge, Mass, with its 200,000 square feet of leaf surface, transpires seven and three quarter tons of watery vapour in twelve diurnal hours of clear weather. From this it is inferred that a grove, consisting of 500 trees, each with a leaf surface equal to that of the elm mentioned, would return to the atmosphere 3,875 tons of aqueous vapour in twelve hours.

HUNGARY possesses some 9,050,140 hectares of forests, comprising about twenty-eight per cent. of the whole territorial area of the kingdom. The most prevalent species of the forest trees are the oak, the beech, the yoke-elm, the birch tree, the elm, the long-haired oak, the pine, the fir tree, and the larch, the latter species being the most abundant among the conical trees. The oak reaches a remarkable height in certain districts; the beech thrives best in the mountainous regions, where it is found in great abundance. The greater portion of the Hungarian forests are the property of the Crown, the revenues derived from the occasional sale of large tracts being very considerable. The activity of the commerce in wood in Hungary has necessitated the multiplication of the means of transport, the construction of additional roads, canals, and even railway tracks, in order to facilitate the removal of timber, both for building and domestic purposes. During the period of the last four years the Hungarian forests have produced 1,751,580 cubic metres of timber; of this amount the oak alone contributed 116,200 cubic metres, the remainder of 1,635,380 cubic metres being furnished by the other species mentioned above. The sum derived from the sale of this timber, and the wood used as fuel, amounts to 6,388,977 florins, the net produce, upon deducting from this amount three millions of florins for expenses and maintenance, being 3,388,977 florins.—*Land and Water.*

INDIAN FORESTRY.

TO THE EDITOR.

SIR,—A great deal has been written and said lately regarding the management of our Indian forests.

I can only express a knowledge of forests in the N.-W. P. and the plains of the Punjab. The latter are pure and simple plantations and as such may be dismissed at once as they are quite peculiar to the Punjab.

Let us take the N.-W. P. forests in detail and see what is to be said about them.

For the Hills we have deodar and chir (*cedrus deodorus* and *pinus longifolia*) as the principal woods of a market value; *chil* (*pinus excelsior*) is found in some places but costs as much to export as deodar. Deodar is exported for railway sleepers, the small quantity sawn up for any other market hardly requires any notice, as the railways can use all our spare wood.

Now what are a forest officers duties in deodar forests? I should say to keep out fires, to select trees for felling and to protect as much as possible seedlings and standing trees from damage in rolling, &c. If fires are kept out, the forest will reproduce itself, provided all grazing is prevented.

For *pinus longifolia* and *pinus excelsior* forests the same rule applies. For sal forests sain, *shisham tun* (*shorea robusta tormentosa*), the same rules apply, keep out fires and grazing, and your young stuff comes up. What more do you want or rather what more can you get?

At our present state of existence planting, sowing, preserving, and such like cannot pay. If fires are kept out as well as grazing, the forest officer is a good one. If not he is bad. Indian forestry of our time resolves itself into this, of course, the forest officer has other duties such as finding the best market for his timber and minor produce, collecting his grazing dues strictly and preventing stealing, but this is all the work of to-day. For posterity our forests are kept up and should be managed in such a way as to ensure no reduction in value of the property and an increase in value where possible. The man who makes two blades of grass grow where one grew formerely, is a benefactor. If the forest officer keeps out fires and grazing he will have twenty trees where he found only one. This is the art of foresty for this generation. As to the art being taught in France, Scotland, England or elsewhere, I should say it will be taught better by setting the men to work as youngsters in the forests of India.

Of course the Forest Department has its plantations and imported tree gardens, but if the truth must be told they are only play grounds of the senior officers. The woods produced in India are quite good enough for all purposes of building and as sleepers for railways, as to malarias and trees that dispel their charms they are for the consideration of municipalities.

A forest officer should enter young, be of a good sound constitution, with a reasonable amount of the sporting instincts in him, active, and as much of a gentleman as can be got for the money. His having a taste for botany and natural history will be a great inducement to his going more into nooks and corners, for the same reason a liking for sport is a good thing, as it takes him out at all hours, combining business and pleasure, helping him to check irregularities and making his solitary life enjoyable. I know that many places and many officers have succeeded in growing plantations, I have myself, but there is so much forest to be protected, that they count as next to nothing, except as experiments, and I can say for nearly certain that these experiments would have succeeded as well, if some of our Department had not been trained on the Continent. As to finding the best market for produce that the trained men had to learn out here as to protecting from fire and grazing, that is only to be done by sheer hard work and requires no training better than is got by finding out for yourself on the fire lines what a difficult task it is.

PRUNING KNIFE.

MINERALOGY.

GOLD IN WYNAAD.

WE are informed by a mining engineer, whose experience in Wynaad has extended over a lengthened residence there, and whose previous experience in the Australian gold fields entitles his report to respect, that the reefs in Wynaad are almost all auriferous; they run generally from north to south, dipping towards the west at angles of from 40° to 45°. Some may technically be described as block reefs, many of them are continuous, and may be traced superficially for miles, and one in particular is known to maintain its auriferous character for ten miles on the earth's surface.

It is impossible to arrive at an accurate estimate of the yield obtainable from the quartz with the crude machinery available. It is, however, our informant states, certain that there is hardly a quartz reef in Wynaad which, from the presence of metals or minerals such as manganese, copper and iron pyrites, &c., usually co-existent with gold, does not suggest its co-existence. In India, gold mining, in common with many other enterprizes, languishes for want of commercial enterprise preventing a free investment of capital, without which the most hopeful schemes may be paralysed. Reefs have been known elsewhere that at the surface did not yield the least trace of gold, a shaft has been sunk, say, 100 feet, a cross-cut worked and stone obtained, with no better result; the shaft has been further sunk 200 feet, making a total depth of 300 feet, another cross-cut started and stone obtained which has yielded 2 oz. of gold per ton. Our informant calculates that if any of the prospecting concerns in Wynaad had sunk shafts to a depth of 200 feet, the results would have realised their most sanguine expectations. As it is, they have confined their operations to mere surface prospecting, shewing in the result that to do so is a mere waste of capital and labour, as might have been anticipated by any man of scientific attainments, or experience, whereas a system of thorough exploitation by means of deep and continuous shafting on scientific principles would have probably led to opposite results.

Our informant, who has worked several concerns in Wynaad, crushed about 40 tons of quartz on one occasion from the Alpha claim, at a point known as Wright's reef, which yielded 5 dwt. of gold per ton. In connection with the same company, he conducted crushing operations during a month from a large quantity of surface quartz, obtaining 3 dwt. per ton. Even at the latter yield, he avers that the operations, under discreet direction, would show a large margin for a dividend. But the "Alpha" concern had too little capital in the first instance for their undertaking, and excluded, perhaps, enterprising capitalists, whose means were required for extending operations, as the original capital had been almost spent in surface prospecting, and might be considered as absolutely lost if not backed by new accessions.

The gold found in Wynaad is so fine that special machinery must be improvised. Several trial crushings were made from quartz taken from the reefs on the Alpha and other claims. This was done by hand, and in small quantities, and the washing was done by the *Curambose*, the mining class of Wynaad, with results

shewing a product ranging from 10 dwt. to 20 oz. of gold per ton of stone crushed. Many such trials were made, with similar results. After these trials, machinery was introduced, but they could not produce more than a half dwt. per ton. Mr. King, a geologist in Government employment, having also made experimental crushings by hand, was disposed to favor the introduction of machinery by the Alpha concern, but it turned out a failure, though he was justified in his estimate of product, *i.e.*, 10 dwt. per ton, so that it was evident the machinery was imperfect and the gold lost in manipulation. The management of the Alpha Company's operations then fell into the hands of our informant, who could only produce 5 dwt. per ton of quartz crushed. He advised the stoppage of all operations, as the Company's capital had been expended, and that the capital should be increased to the extent of another lakh of rupees, so as to open up the mines, as should have been done at the outset, by sinking a shaft and a deep level tunnel, and laying down a tramway, the existing machinery to be supplemented and improved, and to save the cost of steam driven by a turbine water wheel.

Mr. Brough Smyth states that the result of his prospecting in Wynaad is so favourable as to justify the expectation that the average yield per ton will amount to ounces. Without professing to be an infallible authority, our informant asserts that no reef in that district will give more than dwts. Picked stone may yield by ounces; he has himself obtained from picked stone on the Messrs. Minchin's estate as much as 80 ounces per ton, but on an average the reef from which it was taken would not yield 10 dwt. per ton throughout. Such an Eldorado as Mr. Smyth suggests, is, however, not necessary to make mining operations remunerative. With sufficient capital, skill and economy, a yield of 3 dwt. would, we believe, show a large net profit. Mining, like other labour, is cheap in India, and this is a peculiar advantage we have over other gold fields, such as those of Australia or Mexico. Two good native miners, properly trained, could mine a ton of quartz daily at a wage of Rs. 200 per annum each, which would be the highest cost for the work of indigenous artizans. Moreover, the *Caramboes* of Wynaad are the class of miners who have worked the gold fields from time immemorial, the trade or pursuit being hereditary. All their trials have proved most successful, owing to their skilled manipulation, whereas operations conducted by European miners and machinery have been a complete failure, and will probably continue to be so, until the machinery used is adapted to the fine nature of the auriferous product, and designed to work in unison with the native manipulators.—*Englishman.*

GOLD IN WYNAAD.

CONCURRENT with the questions as to the metals most suitable for a standard of the currency of the Empire is that of the prevalence of gold itself in different parts of India. A correspondent of professional experience in Wynaad writes anent the impetus which has lately been given to prospecting there:—"As gold and gold mining have become subjects of particular attention, perhaps you may find some notes on the question from one who has professional experience both here and in the Australian gold fields, useful. I have prospected Wynaad throughout, first in connection with Messrs. J. W. Minchin and Co., and as managing engineer of the Alpha Gold Mining Company. I find that the reefs in Wynaad are all auriferous or nearly so; they run, as a rule, north and south, dipping towards the west, making an angle of 40° to 45°, they may be described as block reefs, technically, but are more familiarly known in Cornwall as "taking horse." Many of the reefs are continuous and may be traced for miles. One in particular, whose auriferous properties may be distinguished for ten miles. Gold mining may be now carried on with improved scientific appliances, but unfortunately such are not at hand in Wynaad, so that with the crude machinery now in use there, it is impossible to arrive at an accurate estimate of the yield the quartz may give.

Mr. Brough Smyth from Australia, supposed to be an authority on gold mining, has published for the information of Government, several papers as to the quantities of gold certain reefs in Wynaad will yield. I have carefully perused Mr. Smyth's reports as published up to the present, and regret to say that my personal experience leads me to differ considerably from him, both on the grounds of his *theories*, and as to the estimates themselves. The former being inaccurate, and not based on personal and prolonged observation, renders the latter wholly unreliable.

There is hardly a quartz reef in Wynaad which, from the presence of the metals or minerals such as manganese, iron, or copper pyrites, &c.,—commonly co-existing with gold and suggesting the probability of its existence in such reefs, which I have not prospected, a position Mr. Smyth cannot assume as he has had but a limited opportunity of undertaking so ardent and extensive a task. My opinion is that not one of the reefs in Wynaad should have been neglected, as has been generally the case. In Australia mining enterprize has been such that quartz reefs not *supposed* to be auriferous have been prospected at considerable expense with more or less success, and I feel certain that not a single one in Wynaad would have been passed over without the expense of £1,000 in prospecting, had they been in the same field of enterprize, I am, moreover, morally certain that the results would have been fairly remunerative at a minimum estimate. In India, however, gold mining or any other enterprize languishes for the want of commercial acumen, and though the results of scientific *process* are abundantly proved to be successful elsewhere, here there seems to be a dearth of adventure, which prevents the free investment of capital without which the most hopeful schemes may be paralyzed.

I have known reefs that at the surface would not yield the least trace of gold, when a shaft has been sunk, say, 100 feet, a cross cut worked and stone obtained, the result has not been better, the shaft has been further sunk 200 feet, making a total depth of 300 feet, another cross cut started, and stone obtained which has yielded 2 ounces of gold per ton. It is my humble opinion that had any of the prospecting concerns in Wynaad sunk shafts to a depth of, say, 200 feet, the result would have been most gratifying and have realised the most sanguine expectations. As it is they have confined themselves merely to surface prospecting with results shewing that it is mere loss of labour and capital, which could have been anticipated by any man of scientific attainments and experience as well as myself, whereas a system of thorough exploitation by deep and continuous shafting on scientific principles would have undoubtedly led to opposite results.

I have crushed about 40 tons of quartz from the Alpha claim at a particular part known as Wright's reef, which yielded 5 dwt. of gold per ton. In connection with the same Company, I conducted crushing operations for a month from a large quantity of surface quartz, obtaining 3 dwt. per ton, even at the latter yield the operations, if under discreet and good management would shew a margin of 25 per cent. for dividend. But the Alpha Company had in the first instance too small a capital for their undertaking, the projectors and original shareholders acted as a body of mere co-operative miners, being so tenacious and conservative as to refuse to dispose of their shares on the ordinary temptations of the Stock Exchange or the Share Markets of the Presidency towns. Had their means been adequate, this endeavour to keep out strangers from the concern might have been attended with considerable success; as it was they excluded perhaps capital and enterprize, which are of vital importance when extended and expensive operations are found to be essential—if the capital already sunk in surface prospecting were not to be absolutely lost."

There exist shaftings in Wynaad, such as those at the Skull reef the Strathearn reef and others which prove that those regions were worked in past ages. These, however, may be classed as surface operations, being sunk to a depth of little more than 40 feet into the spurs of the reefs. On one estate three of those shaftings have been connected by tunnels which is quite an unusual circumstance in modern operations; it is a matter of speculation whether such a process was renumerative. History affirms the proposition, and what we know of the actual wealth of Mysore and the adjacent territory proves the "Wealth of India" was not quite a fable, but who can doubt that with the skill now available, and modern machinery the Eldorado of past ages may not be re-opened with benefit to the country? Now in sore need of such a medium, more so perhaps than any other quarter of the world.

Our informant concludes thus:—

"As stated before, the machinery connected with the Alpha was of the most crude kind, and would probably answer for any ordinary reef in Australia, but was certainly not adapted to the Wynaad reefs, the gold, of which is so fine that machinery of some kind must be

introduced to save the very fine gold. For instance, several trial crushings have been taken from the Alpha and other reefs in small quantities, hand-crushed, and then washed by Gammboes, a native of Wynaad, or in other words the original gold miner of Wynaad, and according to quantity of stone crushed, averages of say from 10 dwt. to 20 oz. per ton have been obtained. Many such crushings have been taken from the Skull reef, *i.e.*, Alpha, and all or nearly all the results before the present Alpha machinery was erected proved that the reef would yield about 10 dwt. per ton; but after the first crushing of the Alpha Company by an engineer by the name of Binney, ½ dwt. per ton could not be obtained. Crushings were made by Mr. King, the Government Geologist, who was certain when the Alpha started their machinery, that the results would be equal to, if not better, than his own; but unfortunately it was a failure, and as far as I can remember, not even ½ dwt. per ton could be obtained, although there is not the slightest doubt that there is the quantity of gold, the reef which Mr. King estimated though it is lost in manipulation. Mr. Binney came over from Australia with the machinery, and no doubt was a good or fair mechanical engineer, but he certainly knew nothing about the manipulation of gold. I was then asked to take charge of the Company as manager and engineer. I did all I could for the Company but I must say that that was not much, the Company was at the end of its resources when I took over charge, and were compelled to borrow. From the first I pointed out to the Directors that the proper steps to be taken after my first crushing, *viz.*, 5 dwts. was to stop all further operations, appeal to the shareholders and public, increase their capital to another lakh, and open up their mines which should have been done in the first place but has not been even to this time.

Three dwts. of Wynaad gold at the present rate of exchange would be worth about Rs. 6; this would represent Rs. 6 per ton of quartz. Now, say, a Company started with a capital of Rs. 150,000. Machinery costing say Rs. 75,000, opening up of mines, plant, tools, &c., another 75,000, making a total of Rs. 150,000; this machinery would crush 100 tons per day, value of which would be Rs. 600, or per annum Rs. 189,800. The working expenses of such a Company would be as follows:—Manager, say Rs. 1,000 per month, six miners at Rs. 200 each, Rs. 1,200; mining 31,300 tons of quartz at Re. 1 per ton, Rs. 31,300; engineers, say one, Rs. 300; machine-men, say 3, at 200 each, making a total of Rs. 600; 9 stamp-men at Rs. 10, Rs. 90; cleaning-up-men 24, at Rs. 8, Rs. 192; wear and tear &c., Rs. 17,000; after deducting such working expenses the result would according to my estimate give a profit of 75 per cent. per annum. Of course the mine and machinery must be worked on scientific principles, the great advantage of gold mining or any other such enterprise in India is that labour is cheap. Before a piece of machinery came on the ground I suggest that a shaft should be sunk, deep level tunnels started and trams laid down; the machinery at present in use with improvements and driven by a turbine water wheel, as steam is expensive would be suitable.

Mr. Brough Smyth mentions that the results of his prospecting in Wynaad have been so successful, that the average quantity of gold per ton will average an ounce. Now I am not much of an authority perhaps upon those matters, but maintain that no reef in Wynaad will yield an ounce per ton throughout; a dwt. perhaps would be more likely; as a matter of course picked stone will do so, I have obtained from picked stone from some of Minchin's reef as much as 80 oz. per ton, although the same reef would not yield on average 10 dwt. per ton, neither are such large quantities of gold wanted to pay in Wynaad. With capital and skill I maintain that 3 dwt. per ton would yield 75 per cent. or more on capital expended. Two good native miners properly trained, could mine one ton of quartz per day and more too, provided that the mine was properly opened up. You will observe that I have left a large item for sundries &c., which I think would be sufficient for stulling. Timbering and stulling will not cost much, as there are so many advantages in this particular district. A tram can be laid down from one of the hills quite close to any run that may be required to be stulled; consequently this item will cost nothing in a mining point of view. I mainly wish to show that it does not require an ounce per ton to pay in Wynaad, but the moderate sum of 3 dwts. would as stated, give a dividend of 75 per cent."

The Planters' Gazette.

TEA.

THE PROSPECTS OF TEA.

A CAREFUL examination of the share list—a document by the way not to be depended upon much—will convince any one that tea is at this moment suffering apparently from one of those periodical depressions that cloud its generally onward movement. Why should these scares come at all, and if tea is a good and a safe speculation why do these unfortunate checks come to interfere with the general progress of the enterprise? The same is asked every day about the financing of the Indian Government, and the same answer would suffice in both cases *viz.*, bad management somewhere. We do not mean to insinuate that estates are now systematically managed in a faulty manner, far from it, we fancy bad management is now the exception, but a very large number of estates are suffering, and will continue to suffer from the results of the bad managing of former owners, possibly first directors or promoters.

In 1867 and 1868, a commission went to the North Eastern tea districts to enquire into the whole subject, their main object clearly being a careful enquiry into the working of the Emigration Act, then existing, but the members of the commission collected a mass of information on the tea industry generally, which is very interesting. With this experience of the subsequent eleven years that have elapsed since that time, a slight modification of the views thus entertained might be made; but on going carefully over the report we are astonished at the soundness of the views then held by the various planters who gave evidence before the commission, and the correctness of the vaticinations then made of the probable future of the industry. They also gave in many instances statistical information which on carefully going over we find to be very valuable. For instance, planters were asked this question.

"What a new garden ought to cost by the time it came into such a condition, as to cover the working expenses of the season?" And many of them answered this question, one made the cost Rs. 470, and we specially quote his amount as he gives closely detailed estimates to show how he arrived at that amount. Some were as low as Rs. 230, and others as high as Rs. 800. The general average being about Rs. 450.

Now this evidence, coupled with our experience in tea on the garden and in the counting house, leads us to lay down the following fundamental principles or rather axioms.

1.—That an acre of tea should, as a general rule, cost not more than Rs. 500.

2.—That an acre of tea should, with average high cultivation produce, one year with another, not less than 400 lbs. of tea.

3.—That including the cost of this average high cultivation, this tea should cost laid down in Calcutta including *all* charges not more that eight annas per lb.

4.—That this tea should realize not less than twelve annas per lb. nett in Calcutta.

In certain districts these axioms might be subjected to slight—very slight—modification, but as a general rule, we believe, they are correct.

The conclusions to be drawn from them then are these:—

1.—*That the capital of a Company should as a rule not exceed Rs. 500 for every acre under tea.*

2.—That when this tea comes into full bearing, say on and after its fifth year, the profits of each acre of tea, should be one hundred rupees, and

3.—That therefore the annual dividend should be at the rate of twenty per cent.

Here is a case in point. The Dehra Doon Tea Co. had a very successful season last year. Here are their figures:—

Total bearing area	...	...	657	acres.
Produce ...	...	...	3,05,027	lbs.
" per acre	...	...	464	"
The tea cost to make	...	...	6·048	as. per lb.
And sold for	...	...	9·542	as. "

Thus leaving a profit in round numbers of 3¼ annas per lb., or Rs. 101-8 per acre.

How about the dividend? It should have been at the rate of 20 per cent. but it was only 5 per cent. The great reason being that the original cost of the property is out of all proportion to its true value, with a full bearing area of 657 acres, and a capital of Rs. 8,78,000 each acre has to provide a dividend upon Rs. 1,336 instead of as about Rs. 500. This explains the apparent mystery.

For the sake of comparison let us take another Company, but one having a small capital relatively to acreage. Let us take what is considered one of the most successful gardens in India. The Kuttal Co., whose shares of Rs. 5,000 each are now selling at Rs. 13,000, and whose dividends for the last three seasons have averaged 25½ per cent., the figures being 38½, 15, and 23 per cents. We have before us the report of 1877, and take the following particulars from it.

Under tea in full bearing 397 acres. Young tea 137 acres. Now if we estimate this young tea as of different ages, and all as half bearing we arrive at a full bearing area of 465 acres. The tea made was only 1,02,346 lbs. representing only 220 lbs. per acre. It cost 10·923 annas per lb., to make and realized 13·257 annas per lb., thus shewing a profit of only 2·334 annas per lb., or Rs. 32-1 per acre. Yet look at the dividends. The real secret being that with a full bearing area of 465 acres and a capital of one lakh only, each acre has only to provide a dividend upon Rs. 215. We wonder when shareholders generally will take a more intelligent interest in their own affairs. If they would turn their attention to these details, the directors would be compelled to do the same, and nothing will so surely put the tea industry in a good way, than a speedy reduction of the relatively large capitals that are simply throttling the industry in too many instances—we shall return to this subject.

"WITHIN the last few weeks none of the Java cultures has been so much discussed in the newspapers as that of tea, an article that, excepting with those directly concerned who worked on in silence and steadily sent larger quantities to market, had hitherto scarcely attracted the attention of any one. At Java agricultural congresses, no discussions ever took place on this culture, because none of those present understood anything about it. At only one of these congresses had a single tea planter shewn himself. Three causes have worked together of late to place the tea culture in the foreground; first of all, much of the waste land recently granted on lease is situated higher than the zone most suitable for coffee, and is hence more adapted to the cultivation of the tea shrub; secondly the latest intelligence from Europe shews that London is a more profitable market for the tea planter than Amsterdam; and, thirdly Java teas have been more inquired for during the last few years, in consequence of the marked falling off of the tea culture in China, especially in quality. On the strength of all this it is not improbable that tea production in Java may increase to the same extent as in British India."—*Straits Times.*

IN the *Indian Tea Gazette* for April, appears an article asking why it is that tea—and in fact other Companies—do not as a rule pay when they are formed into Limited Companies? The question has been answered in subsequent issues, as an instance of the truth of the assertion that these Companies are not so well conducted as private concerns. We extract the following from the *Agricultural Gazette of India* Vol. II. page 164.

" The Adulpore estate is the property of three partners, a lady, " and two men of this neighbourhood. Though only 1¼ year " old, it has produced nearly a maund of tea per acre already, " without the slightest distress to, or injury of, the plants; and " this tea has fetched in Calcutta at public sale 13 annas per lb., " and has thereby paid 16 per cent., on the capital invested. " This undeveloped little garden has been growing while folks " have been sleeping, and bids fair to do as well, or better than " similar enterprizes in its neighbourhood of older standing. " Tea in the *Terai* of Darjeeling can be cultivated at a cost of " Rs. 300 per acre for a 2½ year old garden, and will then pay " 49 to 50 per cent., as the outlay. With great care and economy " it can be done for less, say Rs. 200 per acre. Can anything " better be desired by ordinary mortals? "

What was the upshot of this we shall see. In fulness of time we find. " The Adulpore Terai Tea Company Limited," and on looking at the share list of to-day we find the shares marked nominal and the dividends for 1876, 7, and 8, to have been 9, nil, and 7 per cent. respectively, what has become of the 50 per cent?

OUR thanks are due to the Deputy Commissioner, Darjeeling, for kindly placing at our disposal the following information which will, we trust, interest most of our readers.

Tea Statistics.

Years.				No. of Gardens.	Produce in lbs.
1869	...	...	...	55	1,319,743
1870	...	...	...	60	1,704,136
1871	...	...	...	62	2,665,321
1872	...	...	...	78	2,964,363
1873	...	...	...	87	2,994,661
1874	...	...	...	173	3,927,911
1875	...	...	...	121	4,610,753
1876	...	...	...	114	4,181,622
1877	...	...	...	142	5,250,916
1878	...	...	...	144	7,580,910

—*Darjeeling News.*

VARIOUS opinions have, from time to time, been expressed regarding the unremunerative character of investments in tea, and recently a gentleman was examined by the Famine Commission, when at Ootacamund, and deposed to the fact that coffee and cinchona would pay, but tea would *not* pay on these Hills. We thought at the time, the assertion was an hazardous one, but enquiry has lead us to believe that the same opinion is entertained by many planters. A gentleman, however, gives the assertion a positive denial, and as we think his opinion of sufficient weight, and as we have his permission for making it public, we give our planting readers the benefit of the same.

He tells us that the following are results obtained by him from his property of about fifty acres in extent, of which a half or twenty-five acres only are plucked. The return of first-class made tea from 1st May last up to date has been 360 pounds per acre. High cultivation is adopted. The soil is not exceptional.—*South of India Observer.*

THE Hunias of Tsaparang, in Tibet, are very fond of tea, of which they drink in considerable quantities; they first make a very strong infusion; a cupful of this is put into a pot of boiling water, a lump of butter added, and it is then poured into a kind of churn which thoroughly incorporates that butter and the liquid, and gives the mixture a peculiar soft taste. A little soda is generally used in making the first infusion. Brick tea is in general use throughout Tibet, though good leaf tea may sometimes be procured at Gartok at about Rs. 2 per lb. A brick of tea weighs about 8 lbs. and is sold for about Re. 1 per lb., a sum considerably above its intrinsic value. The sale of tea is a Government monopoly, and is forced in a peculiar manner. The Lhassan Government issues a certain quantity of tea to the Governor of each province, for which he has to credit them with a fixed sum. He serves this tea out to the people of his district in quantities according to the wealth and standing of the family, whether they want it or not, and fixes the price himself, of course taking good care to leave a large margin for personal profit over and above the amount he has to credit Lhassa with. Almost every family is obliged to take some tea, only the very poorest from whom payment cannot be squeezed being passed by. The profit made from this monopoly is of course a cogent reason for the prejudice against the introduction of Indian teas, and equally accounts for the fines levied on any traders found trying to bring them in."—*Pioneer.*

Now and for the past couple of years tea has been selling in London at prices which have paid neither planters nor importers. But increased demand will, by and bye, right this state ot things, especially in regard to Indian tea. Already one-fourth of the tea consumed in Britain is of Indian origin. To shew how rapidly the use of tea is spreading in Britain, we need merely contrast the following figures:—

1867, home consumption	...	...	111,000,000 lbs.
1878, " "	...	...	157,692,000 "
Increase in 12 years	...	...	46,692,000 lbs.

The increase per annum has not been much under 4 millions of lbs., while in 1878 the increase over the previous year was more

than six millions—more than three-fourths of the increase, and more than one-fourth of the nearly 159 millions of lbs. consumed, being Indian tea, which only shewed as a fractional part in 1867. The total imports of tea into Britain in 1878 reached 205,461,000lbs. of which 157,692,000lbs. were delivered for the home consumption of less than 40 millions of population; the deliveries for export being 39,551,000lbs. In another decade the tea consumption of Britain will doubtless exceed 200 millions, of which one-half will be the produce of India and Ceylon.—*Ceylon Observer.*

INFORMATION WANTED.

To the Editor.

Sir,—Will any one be good enough to enlighten me on this small yet doubtless important subject, *viz.*, "Cause of tea plants losing the bark."

As far as my judgment carries me, I would not attribute the cause for want of nourishment, for the mere fact of having observed some plants only 2 years old, and in the most healthy part of my estate effected in this manner.

Any information on the above subject will greatly oblige.

A PLANTER.

TEA CULTURE IN CEYLON.

(*To the Editor of the "Ceylon Times."*)

Dear Sir,—In connection with the statements in a leading article in your issue of the 8th instant, it may perhaps interest you and your readers to learn that we have obtained off a small acreage in our Tea Estate in the Rambodda Pass, as much leaf as sufficed in being manufactured to yield an out-turn of tea equal to 600 lbs. per acre. I venture to say that it will take any estate at Avisawella a long time to beat that, though I should be delighted to hear that others had met with even greater success than ourselves.

It is scarcely necessary to remind you that with our facilities of transport as compared with Assam, a much smaller yield per acre here, should suffice to ensure a profit in Ceylon.

Yours faithfully,

C. W. HORSFALL,

Manager.

COFFEE.

GALIGNANI states that M. Jobert, who is engaged in Brazil in certain scientific researches on behalf of the Emperor of that country, has just forwarded to the Academy of Sciences some particulars relative to a disease of the coffee tree, which is now devastating some of the finest plantations in the Empire. The most vigorous trees, those of from seven to ten years old, are generally first attacked, and the disease makes its appearance principally on the banks of watercourses or in humid valleys. A tree which, to all outward seeming, is hardy and strong, will within twenty-four hours, begin to droop, the leaves turn pale, then fall off, those at the top first. In a week, and often less, the plant is leafless, and the extremity of its branches already dried up; it is irrevocably lost. On digging it up, all the rootlets have disappeared, and the roots, of the thickness of a quill, look as if they had been gnawed. The bark on the trunk presents no abnormal appearance, but, on removing it, the young wood is seen to be attacked. On a closer examination, the roots are found to be covered with nodosities, or small lumps, the largest of which do not exceed in size a grain of linseed or a small pea; the general aspect is that of the root of the vine when attacked by the phylloxera. In making incisions on the swellings above mentioned they are found to present kysts, or small hollows, which have completely destroyed the texture of the root. In those chambers are found multitudes of minute worms, which, when they first issue from the egg which produces them are little more than a quarter of a millimetre in length. They belong to a species of minute parasites called anguillulæ, and forty to fifty eggs are found in each kyst. M. Jobert calculates that a single tree may contain more than thirty millions of those destructive little animals which make up by their numbers for their want of bulk. When they have arrived at their term of full development, they are but little larger, and then they force their way outwards through the bark, leaving the root to rot, which it does very speedily.

According to a correspondent of an Indian contemporary, Liberian coffee has not proved such a success on the Shevaroys as was anticipated. The growth of the plant is anything but rapid, while it is most susceptible to disease, to which it falls an easy victim. The low-lying tracts of land round the foot of the Hills are more adopted to the cultivation of this coffee than the Hills themselves, and successful experiment near the foot of the Ahtoor ghaut gives good ground for expecting that Liberian coffee in these parts would answer as a speculation.

The Mercara correspondent of the *Madras Standard* says:—It may perhaps not be generally known to your readers, that there are and have been for over a year, above half a hundred of the richest and finest coffee estates for sale; they belonged to the late Mr. D. Stewart. A few of them are in North Coorg, commonly known as the Ghât estates, whilst the remainder and by far the greater number are in South Coorg, or "the bamboo." They have been advertised in some Indian and Ceylon papers, but to the best of my knowledge no application has been made for any of them, nor have any been disposed of to gentlemen out of Coorg. How it comes to pass that such a rare and splendid opportunity for investment passes unheeded I cannot* comprehend. There are early choice of locality, temperature, and situation; bungalows and pulp-houses, &c., complete, whilst the majority of the estates are in young bearing coffee. The many exaggerated and frightful accounts of the ravages of the borer in this neighbourhood have given Coorg a bad name, and may have deterred purchasers. I think they have been sadly overstated; anyhow of late years they have much decreased.

One of the late Mr. Stewart's estates was bought last April for £10,000; it was of 500 acres. It yielded last year over 50 tons of coffee, which in round numbers represent £5,000. As I am assured this estate will in all probability produce for the coming season over 70 tons or £7,000, it promises to be a success to its lucky Scotch investor.

COFFEE TAXATION IN MYSORE.

IN his racy work on the "Experiences of a Planter in the Jungles of Mysore," Mr. Robert H. Elliot, in alluding to the early days of coffee-planting in the Province, humorously remarks:—"Then we had no grievances in those days; but this source of unhappiness has now been removed, and is there not the Munserabad Planters' Association which ventilates whatever woes can be found?" Mr. Elliot obviously means to be "kinder sarkastic" in his remarks, as Artemus Ward would say, but we are sure that those of our planting readers who have watched the untiring efforts of the Mysore Planters' Association on behalf of the little commonwealth whose cause it espouses, will agree with us that the "sarkasm" is unmerited. The Planters' Association of Mysore is an instance of British pluck and perseverance, and its operations have resulted most beneficially for the planters of the province. It was a hard fight; the members of the Association had to constrain the Government to recognise the planters' rights and to pay heed to their grievances. But, at length, good seems to be resulting from the intercessions of the Association, and a brighter day is dawning for the sorely-tried and much-badgered planters of Mysore. The attention of the Mysore Planters' Association is now being directed, we believe, among other subjects, to the important one of coffee-taxation in Mysore. Some four or five months ago we dwelt, at some length, on the minute of the Chief Commissioner of Mysore, on the taxing of coffee-lands in that province, and as the agitation on the subject has been revived, it might not be out of place were we to offer a few further remarks upon this question.

The subject of coffee taxation in Mysore has long been a sore grievance with the planters in that province. The *halut* or excise tax hitherto imposed, as our readers must be aware, amounts to *one rupee per cwt.* which would come to *five rupees per acre*, at lowest, whereas in *British territory* the acreage tax is *only* two rupees per acre. Successive Chief Commissioners, importuned by the Planters' Association, have given the subject consideration, but it was left for Mr. Gordon, the present head of the administration, to adopt practical measures to settle the grievance. As to the form of taxation, the planters were divided, some voting for a reduced *halut* tax and others for an acreage rate. Mr. Gordon's minute has been viewed in different lights by various planters. Some are contented with Mr. Gordon's concessions, while others again consider his terms too hard and exacting. Since writing last on this subject we have had opportunities of testing the various objections put forward against Mr. Gordon's minute. While in some points the

planters have good grounds to take exception to Mr. Gordon's terms, in others the objections are frivolous. Mr. Gordon proposes to levy an acreage rate all round on coffee land, of Rs. 1-8 per acre. No exemption will be made for uncultivated and unproductive land forming a part of an estate, but where the grass and unculturable land forms a separate block of not less than a limited extent, it is to be separately demarcated and charged with a pasturage rate of eight annas per acre. As soon as the waste land is brought under cultivation, the full rate of Rs. 1-8 is to be charged. Mr. Gordon remarks:—"The assessment of Rs. 1-8 per acre proposed to be fixed all round, must be regarded as a minimum rate providing for all circumstances, and not as professing to be an exact and nice assessment obtained according to quality." Mr. Gordon further provides that unplanted lands fit for coffee, and lands abandoned, owing to the ravages of the borer and other causes, may also be assessed at eight annas per acre, provided they form separate blocks. The concessions as to the waste land are to last for six years, but will not come into force until two years after the introduction of the acreage tax, to allow of demarcations being made. Meanwhile, as a compensation for the hardship involved in the postponement of the concession, the whole area will be temporarily assessed at the rate of one rupee per acre for the two years.

Now let us see what are the objections which have been raised to Mr. Gordon's terms. In the first place, the assessment of Rs. 1-8 per acre is considered excessive. This appears to us an unreasonable objection. In the adjoining province of Coorg, the rate is Rs. 2 per acre, and we think that the rate fixed by Mr. Gordon for Mysore is, therefore, a liberal one. Neither can it be advanced, with any show of sound argument, that Mysore is at a disadvantage as compared with the coffee districts in British territory with respect to productiveness of land, facilities of labour supply, &c., &c. With regard to the assessment of eight annas per acre on waste blocks, however, we quite agree with the planters that the Government are too exacting. In British territory no assessment whatever is levied for four years on cultivated land attached to coffee estates. It is obviously an oppressive measure to tax man for land which is lying waste, and before you have given him time to bring it under cultivation. The planters complain too, that whereas land cultivated with raggi is assessed at the low rate of six annas per acre, waste blocks on coffee estates are taxed two annas higher! Again, the planters object to the temporary assessment for two years of one rupee per acre, and contend for the lower rate of eight annas. We would suggest, however, that the old estates be assessed at the rate of one rupee the acre, and the new estates at eight annas. This arrangement, we think, should satisfy the Government as well as the planters. These are, briefly, the principal points in dispute between the planters and the Government of Mysore, with respect to the question of coffee taxation. The planters have our warmest sympathy, but we would counsel them, in preferring their grievances to Government, not to be unreasonable and too exacting in their demands. While standing up for their rights and privileges let them remember that their Government, grasping though it has hitherto been, is to be considered too, and that it would never do while securing reduction of taxes for their plantations, to ignore the right of the authorities to derive a reasonable amount of revenue from the production of the estates.—*Madras Times.*

COFFEE LEAF DISEASE.

THE following paper, by the Rev. R. Abbay, M.A., F.G.S., was read at a recent meeting of the Linnæan Society:—

"One of the greatest scourges which the coffee enterprise of Southern India and Ceylon has had to contend with, is, without doubt, *Hemileia vastatrix*, or the so-called coffee leaf disease. Appearing first on a new estate in Madulsima, a district in the south-eastern corner of the mountain zone of Ceylon and bordering on the Low country, it spread with remarkable rapidity over the various coffee districts, attacking both old and young trees with almost equal severity. At first the 'disease' was regarded by those best able to judge as a temporary one, which would run its course for a year or two and then disappear as mysteriously as it came. This view was strengthened by the apparent departure of the pest before the rainy monsoon came on; but with the return of dry weather it reappeared. The effect of the disease presently became apparent in a diminution of the fruit which the tree yielded; and in 1872 the matter was recognised as serious. Previous to and including 1871, the average yield for five years over the whole island had been 4·5 cwt. per acre, whilst for the five succeeding years the average has been only 2·9 cwt., a decrease in the production of somewhat more than one-third. A portion of this decrease is believed to have been due to exceptionally unfavourable seasons for the blossoming and development of the fruit.

"During the earlier years of the ravages of the pest all traces of it disappeared so completely in different districts, and the trees, when relieved, from its influence, so readily put forth new foliage and bore considerable crops, that hopes were entertained that the mischief would soon and entirely pass away. This feeling was increased by the fact that no tree had ever been known to be killed by the disease, however frequent and repeated the attacks might be. It soon, however, became evident that many of the trees so affected, more especially the old and decrepit, were losing a portion of their vigour, the crop reaching maturity, as shown by the statistics, being below the estimate formed by experienced men immediately after the blossoms had set, an unmistakable sign that these particular trees were losing in some measure the power to perfectly ripen their fruit. Besides this, a larger proportion of light coffee, *i.e.* of deaf beans, was noticed.

"Absolutely nothing is known as to the origin of the pest beyond what has been already stated. It is found on no other plant except the coffee tree, nor until some sixteen or eighteen months ago, when it appeared in Sumatra, in any other country except Ceylon and Southern India. It is, however, almost impossible that Java can escape the importation of it from Sumatra, but it is perhaps matter of doubt whether the conditions of the climate are so favourable to its growth and development, as those of Ceylon seem to be. If such be the case, production of coffee in the East, if not also in Brazil, may, at no distant date, be restricted, unless, as is possible, some method should be discovered of successfully contending with the pest. The vitality of the spores of the fungus is somewhat remarkable, and apparently places no limit to the distance to which they may be conveyed, or to the period during which they will retain their power of germination. The writer has at the present time spores growing readily, which were sent from Sumatra to Ceylon sixteen months ago, and afterwards transmitted in the middle of winter to England.

"The first indication of the disease is a palish discolouration in spots or patches, easily detected when the leaf is held up to the light. These quickly assume a faint yellow colour, and, presently, become covered with bright yellow dust, which soon turns to a rich orange. These are the ripening spores, or rather sporanges, of the fungus aggregated in little clusters just visible to the unassisted eye. A superficial examination of the disease spots suggests that the infection must come from without, and not from the juices within the leaf itself; for it is improbable if the latter were the case, that the nerves of the leaf could form barriers beyond which the disease spot could not spread. It seems natural to suppose that the hypothesis is borne out by microscopic observations, that each disease spot is the result of a germinating body, which has fixed itself at a point which is afterwards the centre of the spot.

"In more than one district it has been noticed that a strong wind has apparently had a great effect in carrying the disease up or down a valley, most probably by spreading the spores from some badly infected estate over the comparative healthy ones. If such is really the case, the fact points to the conveyance of the disease to the tree through the stomates of the leaf, and not through the roots. It might be possible under such conditions to moderate the violence of the pest in some of the more isolated districts, if all the proprietors would combine to gather and burn, at the commencement of the chief annual attack, all the diseased leaves and twigs that are at present allowed to lie on the ground beneath the trees until they decay. Such a plan would no doubt be expensive, but it would certainly destroy a vast number of spores and might sensibly reduce the violence of the disease. The sprinkling of quick-lime on the ground beneath the trees has, in one instance at least proved beneficial; and as it would no doubt destroy all the spores it came in contact with, it is not improbable that the two remedies, if applied simultaneously, might be found in some degree successful. The trees should also be washed with some suitable disinfectant, and the watering of the ground with the same disinfectant might possibly prove more beneficial than sprinkling with lime. It would be of little or no use for one planter in a district to attempt these remedies if the others did not—the spores produced on a single badly-diseased tree being so enormously numerous, that a whole estate of healthy plants might easily be infected by a single unhealthy plant in their neighbourhood.

"It has been asserted at various times that native, *i.e.*, unpruned and uncultivated coffee, as well as plants of the Liberian species, are exempt from attacks of the *Hemileia vastatrix*. This is not the case. The former suffers to very nearly the same extent as the cultivated tree; while the latter showed that it was susceptible to the disease by being badly attacked within a few months after the first plants of the species were introduced into the island."—*Produce Market Review.*

CINCHONA.

CHEMICAL VALUE OF CINCHONA BARKS.

THE production of cinchona bark differs materially from that of other products, inasmuch as the value of its constituent parts varies according to circumstances, and according to the part of the tree from which it is removed. This forms a very distinctive feature in cinchona cultivation, for whilst high culture will, in the cases of coffee, tea, and cacao simply add to the yield, in the case of cinchona it exercises a marked effect on the proportion of the different alkaloids formed within the bark. It is now thought by cinchona cultivators that special manures may be prepared, which shall have the effect of increasing the yield of special alkaloids, and with this object in view experiments are now being carried on.

According to analyses made by Howard, root bark yields the largest amount of alkaloids, that of the stem somewhat less, and that of the branches least of all. The following figures illustrate not only the total yield in each case, but also the percentage composition of alkaloid contents of branch, stem, and root bark. The results were obtained from Darjeeling red bark, and may be regarded, as illustrating the varieties in the other species :—

	Branch.	Stem.	Root.
Total alkaloid per cent. ...	3·3	5·5	7·6
Composed of			
Quinine	28·5	20·2	11·5
Quinidine	·6	·6	2·9
Cinchonidine	25·3	23·6	19 9
Cinchonine	19·4	32·8	47·3
Amorphous	31·2	22·8	15·4

It must be borne in mind that although the medical properties of quinidine and cinchonidine differ but slightly from those of quinine, professional practitioners in Europe have not yet recognised their value as curatives, and hence all bark sent for sale to the markets of Europe are valued only in proportion to the quinine they contain, that being the only alkaloid recognised by the profession.

This is not the case in India, where the curative properties of the other alkaloids have for some time engaged special attention. The importance of determining the medical values of these different products may be understood from the fact that in low altitudes, where the yield of red bark is greatest, the percentage of quinine is but trifling, not sufficient, indeed, to render the cultivation profitable, whilst this variety grown in such localities are particularly rich in cinchonidine. This fact having been represented to the Secretary of State, a Commission of Enquiry was instituted with a view to test the actual curative properties of the different alkaloids prepared for the purpose by Howard, who produced them all in the form of sulphates. They were tried in malarious districts in India, and the total number of cases tried was 2,472, of which 849 were treated with quinine, 664 with quinidine, 559 with cinchonine and 403 with cinchonidine. Of all these patients, 2,445 were cured.

The relative febrifugal value of the alkaloids as shown by these experiments has been expressed as follows :—

Quinidine ratio of failures per 1,000 cases treated			...	6
Quinine	ditto	ditto	ditto ...	7
Cinchonidine	ditto	ditto	ditto ...	10
Cinchonine	ditto	ditto	ditto ...	23

From this table it appears pretty plainly that the remedial value of quinine, quinidine, and cinchonidine in fever cases differs but slightly. Cinchonidine seems to be less efficacious than the others, and it has also the disadvantage of being more liable to cause nausea, vomiting, and other disagreeable symptoms. With regard to the results of these experiments, the Commission of 1866 observe, "with the exception of cinchonine, they, in a remarkable degree so closely resemble each other in therapeutical and physiological action, as to render distinctive description of little or no practical value. Unfortunately for cinchona cultivators, this view has not yet been generally accepted by the medical profession in Europe, but there can be no doubt that sooner or later they must yield to invincible facts, and give official recognition to the medicinal value of quinidine, cinchonidine, and cinchonine. Indeed, up to the date of the publication of the British Pharmacopœia in 1865, the profession in England were using a mixture of the alkaloids and not pure quinine, so that their persistent preference for it is more or less a prejudice, without any sound therapeutical basis."

With a view to give a practical result to the researches of the Commission, efforts have for some time been directed towards the preparation of a febrifuge that should contain all the active properties of these various alkaloids in a convenient and economical form. So far as these experiments have yet gone, they have been successful in producing a fever remedy containing a more bulky concentration of the alkaloids than in European preparations, answering all these purposes in the treatment of fever, but not at as low a price as they can be prepared in England. Thus we find that whilst a cinchona febrifuge locally prepared was sold on the spot at Rs. 20 per lb., sulphate of cinchonine could be bought for Rs. 5 per lb. and sulphate of cinchonidine for Rs. 17-8 per lb. in England, the equivalent of three shillings an ounce. The means of cheap manufacture are so much readier in Europe than in India that it is possible all supplies for the presidencies may be imported in this way from London, until farther improvements can be made by Indian experts. At the same time it must be borne in mind that there are inferior qualities of bark capable of yielding alkaloids which will not bear the cost of shipment to Europe.

The locality of manufacture is, however, of a small amount. What is wanted is to establish the fact that barks containing other alkaloids than quinine, have a good marketable value. Once this is accomplished a demand will arise for such barks as may be grown at lower altitudes than hitherto, and in this way the area of cinchona cultivation will be much extended, and land will at once assume a value for this purpose which it does not now possess. We are not aware if any of the newly prepared cheap forms of alkaloids have been tested in the hospitals of Ceylon. If not, we shall hope to hear that they are to be tried, as their use involves a considerable saving in cost, and it behoves this Government, fully as much as that of India to do all in its power to aid the development of the cinchona industry.—*Ceylon Times.*

WONDERFUL RESULTS IN ANALYSES OF CEYLON CINCHONA.

OUR readers will notice that at a sale in London of cinchona bark some was bought in at 10*s*. per lb. This may, possibly be the bark referred to in a communication which has reached us by this mail. Specimens were sent to Paris to be tested, and the results reported were :—

Samples	No. 1	No. 2	No. 3.
Mixed alkaloids—*Total*	41·	36·30	35·70
Alkaloids insoluble in ether	16·60	9·20	9·50
„ soluble „	24·40	27·10	26·20
Giving sulphate of quinine	18·75	16·64	21·35

Our correspondent adds : "Nos. 1 and 2 were honored with cases, but in Ceylon No. 3 was not thought well enough of to have more than a bag. These trees were tested before and then gave pretty good results. The tests cost 30*s*. each sample. With such a test as these any buyer can see what he is getting and the vendor sees he is getting a fair price. One chemist told me to-day that he always looked out for the highest class of bark. He took out all he wanted and he could always sell it again after he had the first run from it." We do not know whether it is owing to the different method pursued by the French chemists, but the *results* given above go *far* beyond the best obtained in *Java* from the finest *Calisaya ledgeriana* bark. We take it for granted the Ceylon bark tested in Paris was that of *C. officinalis*. If Ceylon officinalis bark has, in one case, given 41 per cent. of alkaloids, and sulphate of quinine at rates rising from 16·44 to 18·75, and even 21·35 (the latter more than one-fifth of the weight of the bark), then, we venture to say that no richer or more valuable bark has yet been produced in the world. The bark giving 21·35 of sulphate of quinine is worth at least £1 sterling per lb. weight. Looking at Mr. Moens' analyses of *Calisaya ledgeriana* bark included in Howard's magnificent work, the figures for the very best are as follows :—

Quinine	10·72
Total alkaloid	12·28
Sulphate of quinine computed	11·42

Subsequent analyses *may* have given somewhat better results, but we cannot recollect any better figures.

We cannot help suspecting some difference in the French mode of testing, but making all allowance it would seem that bark exceedingly rich in alkoloids has gone from Ceylon, and we should like to hear something more of its history.

After writing so far we received the following :—

CINCHONA.

PARTICULARS OF BARK SALES.

20th and 25th March 1879.

214 Bales Calisaya, flat, fair 3*s*. to 3*s*. 3*d*., bought in.
17 do. do. do. bold 4*s*, bought in.
24 do. do. quill, very inferior 1*s*. 6*d*., bought in.
26 do. do. do. Java, small broken 3*s*., bought in.
345 do. New Granadian, good to fine 6*s*. 3*d*. to 8*s*. 6*d*., about 100 sold 3*s*. to 6*s*. 4*d*
215 do. do. fair, 3*s*. to 4*s*. 6*d*., bought in.
162 do. do. very inferior, 9*d*. to 1*s*. 6*d*., bought in.
1457 do. Soft Columbian, middling to good 1*s*. 11*d*. to 4*s*. 8*d*., 200 sold 2*s*. 4*d*. to 4*s*.
69 do. do. sold before the sale.
269 do. Carthagena, good to fine, 3*s*. 6*d*. to 4*s*. 5*d*., all sold.

180 Bales Calysaya fair to good, 3s. to 3s. 2d., all sold.
6 do. do. very inferior, 10d. to 1s. 4d., do.
353 do. Ashy Crown, middling to fine, 1s. to 2s. 3d., all sold.
112 do. Crown and Grey, fair to good, 1s. 6d. to 2s. 11d., all sold.
149 do. Mossy Lima, fair, 5½d. to 7d., bought in.
15 do. Maracaibo, middling, 5½d., bought in.
33 do. Condurango, fair, 3d., bought in.
7 Cases Red, fair flattish, 6s. 4d., sold.
4 do. do. quilly, 3s. 6d., sold.

215 bales E. I. cinchona officinalis, grown in the Government gardens at Ootacamund.

40 bales renewed 8s. 11d. to 11s. 7d.
96 do. mossed 7s. 3d. to 9s. 3d. } all sold.
79 do. natural 5s. 8d. to 7s. 1d.

69 bales E. I. cinchona, at Beypore, succirubra, middling to fair quill, 1s. 8d. to 2s. 11d., sold.

6 cases Ceylon cinchona officinalis, fair to good, 10s., bought in.
48 bags do. do. do. small quill and chips, 2s. 4d. to 3s. 9d., all sold.
22 bags do. do. do. Succirubra, middling quill, 1s. to 1s. 6d., sold.

Your obedient servants,
JENKIN & PHILLIPS.

51, Lime-street, 26th March, 1879.

We beg our readers' special attention to the gradations in the prices paid for bark of the Nilgiri Government. *C. officinalis*, proving the great value of poor McIvor's mossing process :—

Natural bark ...	...	... 5s. 8d. to 7s. 1d.
Mossed ,, ...	...	... 7s. 3d. to 9s. 3d.
Renewed under moss	...	... 8s. 11d. to 11s. 7d.

The use of a "spoke-shave" is the latest expedient we have heard of as adopted to take of the outer bark, in which the alkaloids reside, without injuring the liber or inner bark. In this way mossing can be dispensed with.—*Ceylon Observer.*

THE MELKONDAH CINCHONA PLANTATION.

CAPTAIN J. CAMPBELL WALKER, Deputy Conservator of Forests, on special deputy, has reported upon his enumeration, &c., of the trees on the abandoned cinchona plantation at Melkondah. He says :—

The clearing was a work of great difficulty owing to the dense and thorny nature of the undergrowth which had sprung up and surrounded the cinchona trees, which could not be burnt without destroying the trees themselves, and the absence of available labour at or near the place. We had eventually to get Mopla labour from the Bavani valley below, and although the clearing has been sufficient for the purposes of enumeration, and the work has been carried out within the estimate of Rs. 400, it is not satisfactory, and in some portions of the plantation leaves much to be desired. The upper portion of this plantation site in which 7·03 acres, was cleared and planted by the late Mr. McIvor is, as already reported, perfectly bare of trees, and it is only the lower portion to which this report refers—the area cleared being 35·63 acres, of which only 23·88 acres would appear to have been planted. The total area handed over to the cinchona department at Melkondah was 544·85 acres, of which 335·05 acres was heavy forest. The enumeration gives 8,947 trees remaining alive, of which 3,264 are of fair growth, averaging 12 to 15 feet in height and 6 inches in circumference at 4½ feet from the ground ; the remainder *viz.*, 5,683 trees being stunted and comparatively valueless. The whole may be classed as *C. succirubra*, though there are a few hybrids (chiefly *C. anglica* and *C. micrantha*). It may safely be estimated that the 3,261 fairly-grown trees would yield 6,000lbs. and the smaller ones 3,506lbs. of dry bark, making a total of 9,500lbs. were they rooted up. This quantity at 2s. 6d. per lb., the low sale rate at which I have estimated the bark of the succirubra species in my report (page 40, paragrah 74), would realise £1,187-10-0 ; but from this, the cost of collection, drying packing, carriage, &c., would, of course, have to be deducted. These charges would be very high owing to the situation of the plantation and absence of communications. On the other hand, the value of the unopened forest land may be considered considerable, and I think that Government, should they decide on selling the plantation site, may fairly fix Rs. 10,000 as an upset price. I regret extremely the delay in submission of this report which was unavoidable. I would respectfully urge on Government the necessity of passing early orders as to the retention or disposal of the Melkondah plantation. Although I do not apprehend danger from fire from without, there is the greatest danger within the plantation itself, which is enhanced, not diminished by the recent clearing ; the dry brush wood being, of necessity, left lying between the trees with a rank growth of grass and weeds springing up, a spark would set the whole in a blaze and destroy every tree. Should Government decide on retaining the plantation, a thorough clearing and weeding must at once be undertaken at considerable expense, and extension in the more sheltered portions of the forest, as suggested by the Commissioner, would appear advisable. Should Government decide to sell, the sooner it is done and the risk transferred to the purchaser, the better. On account of the inaccessibility of the site, difficulty of procuring labor, and ensuring adequate supervision I do not hesitate to recommend the latter course. I have already in Chapter III of my report indicated the direction in which I consider Government action in the shape of pioneering and developing cinchona planting in Southern India will be most profitably directed. It does not include the retention or extension in another (the fourth) locality on these Hills.

The Government Order upon the above is as follows :—In G. O., dated 7th November 1878, No. 1,797-A, Captain Walker was deputed to report specially on the Melkondah cinchona plantation, imperfectly noticed in his previous general report on cinchona plantations. The Commissioner of the Nilgiris now forwards this officer's report, and the question is raised whether the Melkondah site shall again be offered for sale, or whether operations shall be continued there on the part of Government. It appears that of the site measuring 544·85 acres, 335·05 acres were originally heavy forest, of which 35·63 acres have been cleared and 23·88 acres have been planted. The plantation now contains 3,264 *C. Succirubra* trees of fair growth and 5,683 stunted ; so there are altogether about 378 trees per acre, and about 160 per acre of fair growth. Looking to the acreage now given it does not appear that the loss of trees in this long abandoned plantation has been so considerable as was at first supposed. Mr. McIvor's estimate of 65,254 trees, quoted at paragraph 24 of Captain Walker's general report was made on the assumption that 75 acres, or three times the real quantity had been planted. The value of the bark now obtainable has, on the supposition that the whole would be coppiced, been estimated at about £1,200 : but from this would have to be deducted the cost of gathering drying, carriage, &c. The proposal to offer the site again for sale is not now approved. Nor does it seem advisable to coppice, where the site is so cumbered with other growth. The Government direct that the bark be harvested by felling and grubbing up the whole, after which the entire Melkondah site can be retransferred to the Forest Department. This method of harvesting will secure the root-bark and thus increase the return, and will also afford useful and interesting information as to the value of root-bark, and the quality of the bark generally when left entirely to natural growth. The Commissioner will see that a reliable and thoroughly competent subordinate is at once deputed to the task, which should be expedited to the utmost.—*Madras Times.*

VALUE OF A PLANTATION OF C. OFFICINALIS.

(To the Editor of the Ceylon Observer.)

DEAR SIR,—It would be very interesting to me and probably to many other of your readers to learn from some good authority on the subject what sort of sum would be likely to represent the approximate value of C. Officinalis per acre, say at 4 years old, and planted 3 feet by 3 feet.—Yours faithfully,

Dikoya, April 27. G

THE difficulty of answering such a question is rendered very great by the tendency of the plants to die off not as individuals merely but in patches. But for this, and were all the plants alive and vigorous, our valuation would be nearer £200 the £100 per acre. We have more than once stated what Mr. Rowson said to us on the Nilgiris, that 100 acres of *C. officinalis*, with 1,000 well-matured tree of the acre, (instead of nearly 5,000 which 3 x 3 would give), would,—the stripping and mossing processes being adopted and each trees yielding only half a pound of dry bark per annum,—represent an annual income of £5,000. There are difficulties in the way of the mossing process in Ceylon, but the trees coppice readily. If our correspondent's trees are four years old and shew no signs of "insidious defunction," he ought not, certainly to look at anything less than £150 per acre, and he might stick out for £200. The habit of dying off baffles all calculations, but be it remembered this very fact increases the value of the trees which come to a healthy maturity.

TOBACCO.

OF late years the cultivation of tobacco in Switzerland has made considerable progress, and the results now obtained are considered highly satisfactory. The largest and most important plantations are to be found in the valley of Broye, and in the neighbourhoods of Payerne, Avenches, Grangeo, and Corcelles. The yearly crop from these districts is estimated at 20,000 quintals of leaves, representing a money value of 800,000 francs. The greater part of these tobaccos find their way to Germany and to Geneva. To ensure success, the cultivation of tobacco demands great care and constant attention, and the soil requires a large amount of rich manure. The average crop per acre may be taken as twelve quintals of leaf, valued at 450 francs while an acre of land under [illegible] rarely yields more than 200 francs worth of produce.

These sums, however, cannot be considered as indicative of the exact difference in the profit obtainable, for the cost of cultivating tobacco is far greater than that of growing grain. In some cantons the tobacco is generally grown on a sort of modified partnership agreement. At the commencement of the spring the proprietor of the land hands it over, ready prepared, to his co-operators. These plant the crop, tend it during growth, get it in when ripe, and dry the leaves in buildings placed at their disposal by the landlord. When the tobacco is fit for market, which is generally about the beginning of the succeeding year, it is carefully weighed out, and divided between the proprietor, and the growers share and share alike.—*Country Gentleman's Magazine.*

SERICULTURE.

SILK CULTURE.

MR. LOTTERI, of Calcutta, lately wrote to the Secretary to the Horticultural Society, Madras, to know if silk cocoons, in which he deals, are available in the Madras Presidency. He says that he is a large dealer in both dead and dry cocoons, and wishes to know where they may be had in large quantities. Dr. Bidie supplied information under this head. He said that from his own personal knowledge and information, tussar silk cocoons are not found in such abundance in Southern India as would render their collection remunerative. Tussar silk cloth used to be made in some part of the Nizams dominions, but in no other place in this part of India. Mr. Lotteri suggested to the Society that measures be taken to encourage the production of cocoons. Their present value is Rs. 4 per 1,000, and the skeins of raw silk forwarded by him to the society show that, if encouraged, the cocoon trade might be remunerative. The Secretary to the Society was of opinion that the cocoons referred to were to be found in casuarina plantations. He had seen several hanging in a single three-year old tree of country almond, and he believed that with a little encouragement it will turn out a profitable industry. Specimens of cocoons gathered in the gardens of the society were placed at the disposal of the members, and it was stated that these cocoons were also available on trees on the banks of the Bhowani river and in the Cuddapah and Kurnool districts.

TUSSER-SILK.

THE Government of Bengal having called for information regarding the cultivation of the tusser-worm in the district of Chota Nagpore, has now received replies from the district officers. Many of these are interesting, but that of the Extra Assistant Commissioner of Palamow contains so much interesting and useful matter that we cannot do better than insert it here bodily from the report kindly furnished us by Mr. Hume.

No. 121, dated Daltongunge, the 18th March 1873.

From—L. R. FORBES, ESQ., Extra Assistant Commissioner, Palamow

To—H. L. OLIPHANT, ESQ., Deputy Commisioner, Lohardugga.

Letter, dated 12th November 1872, from Officiating Junior Secretary to the Government of Bengal, to the Commissioner of Chota Nagpore.

Memo. No. 3176, of the 25th November 1872, from the Commissioner of Chota Nagpore, to the Deputy Commissioner, Lohardugga.

Memo. No. 2651, of 31st January 1873, from the Deputy Commissioner.

I HAVE the honor, with reference to the correspondence marginally noted, to submit the following report on the production of tusser-cocoons.

2. I propose to reply *seriatim* to the six questions put by his Honor the Lieutenant-Governor, adding such information bearing on the subject as I may have collected.

(1) Is tusser-silk (under any name) in the district usually collected from the jungle in the state of cocoons? or are eggs collected and hatched in so-called gardens or enclosures in the jungle? and are the worms tended with care by the growers?

(2) Are tusser-eggs produced by moths in captivity ever fruitful? and are they kept for a future crop of worms?

3. With regard to the first two questions, which I propose to answer together, tusser-cocoons are produced in Palamow and Belounja in large quantities under the name of "koa." From the correspondence before me, I gather that so little is known of the manner of production that I shall venture to give a detailed history of the whole proceeding.

4. I will premise by stating that in this part of India, wild, that is, free jungle-bred cocoons are the exception, domesticated the rule.

5. There are two harvests or breeding seasons in the year, or what Bengal silk-growers call "bunds." The first commences in Assar (June) and ends in Bhadra (August); the second in Assin (September) and ends in Kartic (October-November).

6. The cocoons set aside in Kartic (November) for seed are carefully packed in kodo-straw, in exactly the same manner as is done in the case of seed-dhan, and stowed away in some dry place till the following Assar. I may here remark that the tusser-cocoon has what may be called a stem like a plum or any other such fruit, and that this stem is provided with a ring, which encircles the branch or twig from which the cocoon hangs. When gathering cocoons from the tree, the twig is broken off, so as to leave about a couple inches of the wood adhering to the cocoon.

When gathered for sale the stick is entirely separated. The reason assigned for retaining the wood is that complete separation causes the chrysalis inside to die. Whether this is true or not I cannot say.

7. In the month of Assar (June-July) the cocoons are unpacked, the wood taken out, and the cocoons themselves strung upon string or thread and hung up to the roof inside the house.

From this time the labour of the breeders commences. After the cocoons have been threaded, they have to be carefully guarded from rats and little house-squirrels. The moth eats its way out within six to eight days after threading, and always during the night. The following evening pairing takes place on the cocoons as they hang. The next morning the females are taken off their respective cocoons, their wings tied with a piece of cotton, and they are deposited on little bamboo trays to lay their eggs. I have been unable to ascertain whether males pair twice or not. When incubation is over, the wings of the female are broken off and crushed between the forefinger and thumb over the eggs, so as to allow the soft down to fall upon them. If there is a westerly breese blowing, they are exposed to it: if not, a westerly wind is produced by a small hand-punkah being worked over them from the west. This performance, I fancy, is a mere superstition. When the eggs have been properly dried, they are put into a small receptacle or cradle made of a leaf rolled up into a hollow cone and pegged to, or hung up against the wall. In about eight to nine days the young worms begin to appear, and the cradle is then taken down and carried to the asan plantation, where it is pegged to one of the trees; the leaves immediately above being bent down and pinned over it, so as to protect the young worms and at the same time afford them the means of travelling up the branch.

In two or three days the young worms leave the cradle, crawl up the branch, and spread themselves over the tree. Branches of this tree, with the young worms feeding on the leaves, are then cut off and fastened to other trees, and so on from tree to tree.

8. All that is now required is to protect the feeding worms from birds, ants, a flying insect called "puchool," and other pests. The worm goes on alternately feeding and lying dormant during the time of skin-changing, until spinning commences.

9. The first or Bhadro harvest is for seed only; consequently a very limited quantity of cocoons are reared. These cocoons, when ready, are picked from the trees, packed in nets, and slung to the roof. Twelve days later they are taken down, the wood extracted, and the cocoons threaded as before described, and the process of hatching and rearing goes on the same way.

(3.) On what trees do the worms feed?

10. With reference to the third question, I would state that in this part of the country the domesticated worm is fed only upon the asan-tree. I am not aware that wild cocoons are ever collected in the jungle; in fact, occuring as they do singly here and there, it would not be worth any one's while to do so. The asan-tree, found growing in so-called plantations, is of indigenous growth, and is never planted or grown from seed, though I am told the rearing of young trees from seed would not be a difficult matter. It is, I believe, a quick-growing tree, and capable of being utilized for feeding purposes in the third year; but after 10, or at most 15 years, the leaves appear to lose some necessary ingredient, as the worms will not then feed on them. The trees of most plantations I have seen vary in thickness from three to nine inches in diameter. The tree is never worked two successive years. After the Kartic harvest the tree is pruned and allowed to regain its strength for a whole year; for this reason only half a plantation is worked at one time.

11. In their wild state the worms will feed upon the following trees;—deota, seeda, kokore, bhyre (*Ziziphus jujuba*), khowa, sal (*shorea robusta*), tend, and a few other trees.

12. Speaking of feeding, I would remark that the quality of the cocoon depends not only upon the species of tree, but upon the soil on which the tree grows. Thus an asan plantation on black *keywal* or loam produces large, hard, and heavy cocoons of a black colour; while *keywal* produces cocoons of a dirty white colour, inferior in size and weight to those mentioned above; while wild cocoons found upon koa-trees are much smaller, softer, and of a yellow colour.

(4) If tusser-cocoons are collected in the jungle, can any estimate be formed of the weight collected annually in the district? Is the right to collect them farmed out by the zemindars? And what is approximately the area over which they are collected?

13. It is for several reasons a very difficult matter indeed to form an estimate of the weight of cocoons annually produced. Mr. Deveria, I observe, states that the bazaar maund of cocoons counts 3,440 in number; but I am inclined to doubt the correctness of this statement. As far as I am aware, cocoons are never weighed or sold by weight, but by number; and vary so much in weight according to season and quality, that I do not see how it is possible to fix the number that will go to a certain weight. However, as an average, I believe the number stated by Mr. Deveria may be taken as fairly representing a bazaar maund, and in calculating the quantity yearly produced I have therefore adopted it.

14. Cocoons are counted and sold by the khary, which varies in number from 1,100 to 1,200 cocoons,—more generally the former; the higher number being taken in boundary villages, where, to prevent competition, rents are lower. *Formerly the right to the whole of the* koa revenue of Palamow was in the hands of Government, and was farmed out; but within the last few years three large and one small, estates* have claimed and obtained the right to this revenue. When the whole was in the hands of Government, the revenue derived from this source amounted to Rs. 1,500; it is now Rs. 1,125.

* Ranka, Deogon. | Chainpur. Ladi.

15. The production of cocoons is subject to the following taxes,—*khootkar*, *patkar*, and the *hansua*. (1) Khootkar is the rent demanded by the proprietor or farmer of the land for the land on which the plantation stands, or, more properly, for the use of the trees; (2) patkar is the revenue paid by the farmer of the *koa* revenue to Government,

or to the proprietors of the exempted estates; (3) hansua is the name applied to the tax levied by the farmers of the koa on the produce. In dealing with this subject in my settlement report, I stated that the hansua was a bundle measured like indigo; this was wrong, for I now find that the hansua really means the producer, or *asami*, so called from the hansua, or reaping-hook, used by him in pruning the trees and collecting the cocoons. I have tried in vain to arrive at some definite decision as to the real or average number of kharies contained in a hansua—that is to say, the number of cocoons produced by one person, and by this means to get at the area; but I have found it quite impossible to do so with any degree of exactitude. A hansua means, as I said before, a producer, *i. e.*, each man or family who is found guarding a plantation on which cocoons are feeding, is counted as a hansua, and pays to the farmer a tax of Rs. 4, whether his cocoons are feeding on 5 trees or 500; and as, therefore, this is really the case that while one poor man is working (say) 8 trees, another is working 100, it is manifestly impossible to arrive even at an approximate estimate of a hansua. I have therefore adopted other means. On inquiry from 20 producers I find that on an average, and a very outside average too, the hansua may be considered as 5 kharies of 1,100 cocoons each, or 5,500 cocoons per hansua: but this, as I have said, is a very high average, as taking the average market value of a khary to be Rs. 6, we find the average money value produced by such hansua or assami, to be Rs. 30—a very large sum when we consider the class of people who are engaged in the work. The average amount produced by the 20 growers mentioned above was below Rs. 20; but allowing room for concealment of the true amount, I prefer to assume the hansua to be as above. On inquiry from the present farmers of the koa kuth revenue I find that the average number of hansuas of the last three years on which they have collected tax or rent is 861. To this I would add, as outside figures for the four exempted estates, 750 hansuas and for Belounja and Jupla 400 hansuas, or (say) a total for the entire sub-division of 2,000 hansuas, or 10,000 kharies, or 11,000,000 cocoons, which, assuming Mr. Deveria's estimate of the number going to the bazaar maund to be correct, would give a total of 8,168, or in round numbers 8,170 maunds of cocoons for the whole of Palamow, including pergunnahs Belounja and Jupla. Now as the Palamow sub-division measures 4,260 square miles, or one-fourth of Mr. Deveria's area, it is clear—always supposing that as a cocoon-producing district Palamow fairly represents the whole, and which I have very little doubt it does—that the whole of the area included in Mr. Deveria's calculation as cocoon-producing yields at present at the very outside 12,680 maunds of cocoons,—very different from the marvellous figures given by Mr. Deveria in his memorandum. Of course the figures I have given above appertain only to the quantity now produced. There cannot be a doubt that with European capital and supervision the amount produced could be very largely increased. Supposing Mr. Deveria's calculations to be correct as to the number of trees per beegha, and the average number of cocoons per tree to be 250—a rather high estimate—we find, assuming the number of cocoons produced to be 11,000,000, that there are 44,000×2 trees now being worked, contained in an area of 1,760 beeghas, or 586 acres, less than one square mile.

16. From inquiries I have made, I find that the production of tusser-cocoons has greatly diminished within the last twenty years; some say about one-third. This falling off is ascribed to (1) increase of cultivation and consequent destruction of asan plantations; (2) greater demand for agricultural labour and higher wages, making the production of cocoons a less profitable employment.

17. As I have before said, the asan plantations are of indigenous growth, and are of use only for about 10 to 15 years. At present the Government farmers of koa revenue having the right over about 1,800 villages, show by their accounts and registers that cocoons are bred in 105 only. In a large number of villages there is no asan at all, but it is to be found in most village areas, and is destroyed in large numbers yearly in jooming operations; and though the figures given by Mr. Deveria are absurd and impossible, still the area of cocoon producing trees would be found considerable and quite capable of supplying a very extensive trade. I should say that a truer estimate of the area would be one-sixteenth of the whole, but I should prefer to fix it at one-half of that, or even at one beegha in 50. The limit, therefore, in the extent to which the trade could be developed, depends rather upon the number of hansuas, or persons who could be persuaded to undertake the production of cocoons; and for this reason I should say that a multiplication by 8 of the number of cocoons now produced would fairly represent the limit to which the trade could be expected to reach.

18. The rearing of tusser-cocoons is not confined to any particular class. I have found the following castes occupied in the work:—Cheros, Kherwars, Nraons, Bhunias, Chamars, Dosadhs, Mallahs, and Ghasis, but no Musulmans. Their *modus operandi* may be thus described:—Very few cocoons are kept for seed at the Kartic harvest, and these only by well-to-do producers, who can afford to breed during the Bhadro harvest for the great harvest of Kartic. In Bhadro, therefore, the poorer producers apply to the mahajuns for advances as *byjhan* for the purchase of seed-cocoons, and as *kyhan* for the means of supporting them during the breeding season. This advance is generally given at *dehra*, or 50 per cent; *i. e.*, for every rupee given Re. 1-8 is returned. When the cocoons are ready, the bania or mahajun appears on the ground and collects his due; the remainder is sold by the producer either to the mahajun or in the hauts at prices varying from Rs. 5 to Rs. 7 per khary.

(5) What caste collects the cocoons, who rears the tusser-worms, and what caste sells the tusser-silk, and how? How does such silk sell?

19. Most of the tusser-cocoons are exported to Benares, Mirzapore, and Patna. There are a few Patwas (Gosains) in the sub-district who reel off a few cocoons for making the *sarbunds*, *dandahs*, &c., worn by most of the respectable castes either as waistbands or for fastening ornaments to, but no cloth of any kind is made. Some cloth is made I believe, in the Gya district, but I have never seen it.

20. I have never met with any other variety of silk-producing insect in this part of the country but the ordinary tusser-silkworm, but I believe some such do exist in a wild state.

(6) Are they any, and (if any) what, varieties of insects producing silk besides the ordinary silk-worm and the tusser-silk-worm?

General.

21. It will be seen from the foregoing that in this part of the country the tusser-worm is almost altogether domesticated. The only thing left to render it completely so is to feed it under cover instead of in open plantations. This is the only difficulty, but one which, I am persuaded, can be easily overcome. Before, however, capital could be safely embarked in the trade, it is absolutely necessary that it should be overcome, as at present in open plantations. Not only are the worms exposed to certain pests such as I have detailed, but rain falling upon them in the "hatta" is almost complete destruction; and as rain falls during the hatta every other year and sometimes even for two or three years in succession, it follows that under the circumstances the trade would be a very precarious one.

22. The habits of the worm are so different from those of the ordinary silk-worm, that none of the means employed in rearing the former would be applicable to the latter. The system adopted by Captain Hutton might answer very well for the purposes of a limited experiment; but I am inclined to doubt its capability of being applied on a large scale, chiefly on the score of expense. I should be inclined to try a simpler method. I would erect a shed on the plantation itself, a simple bamboo frame-work roof covered with grass, and supported on green poles cut from the neighbouring jungle, would suffice; the walls to consist of stout bamboo-matting, sufficiently open to admit air and light, but not sufficiently so as to allow of the moths escaping; the flooring I would raise a foot or so with gravel or soil well beaten down, and cover it with date palm-matting, which is not only absurdly cheap, but possesses the invaluable quality that no white ants or insects will touch it. In the centre of the shed I would have a rough frame-work running nearly the whole length, and resting on the matting, but not reaching the roof, so as to cut off communication within this frame-work which may be made of bamboos or rough poles. I could have shelves or *machans* of date palm-matting; the first being at least six inches from the ground, and the next two or three feet above it. On these shelves I would place or heap dry leafless twigs or branches of any bush or tree, interlacing each other and running the whole length of the shelf. To one of these twigs I would fasten the hatching cradle, placing lightly over it a few green leaves from the plantation, and then daily, as the young worms began to wander, I would lightly sprinkle freshly gathered leaves over the twigs, until they had been induced to spread themselves over the whole length of the shelf. When the time came on for spinning, they would attach themselves to the twigs, which of course should be sufficiently far apart as to freely permit the operation of spinning to go on. Should a little moisture be found necessary, a little rain water lightly sprinkled over them with a grass broom would answer very well.

23. For my part, I should be very glad indeed to see the production of tusser-cocoons in these districts in the hands of enterprising European capitalists working on fair and honest principles. Apart from the creation of a valuable industry, the capital yearly thrown amongst the very poorest classes at a time when they most need it would go very far to relieve their necessities and keep them from the door of the usurer. I would not recommend the initiative being taken by the Government, as these kinds of experiments are not generally successful when undertaken by public officers having other and more important calls upon them; but I would suggest that private parties be invited to take the matter up, and, by way of assistance, that the Government allow such persons the free and unconditional use of any one or more of the asan plantations lying within the Government farms.

ADVERTISEMENTS.

Registered No. 182.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA : TUESDAY, 1st JULY, 1879. No. 7.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are made by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

CORRESPONDENCE.

LAC AND ARTESIAN WELLS.

TO THE EDITOR.

SIR,—I see some of your correspondents in the *Agriculturist* require information regarding "lac" and "artesian wells". I was recently perusing a very interesting account of the introduction of the cochineal insect into the Island of Teneriffe where it has now entirely superseded the cultivation of the vine, more profitable it seems to thrive best on the *cactus*, an acre producing lac worth £80 to 90. The insects only require to be put on trees on rags, and they soon spread in India, the cold season would be the best for its cultivation.

With regard to artesian wells,—the implements for boring can easily be procured through any Calcutta contractor, the cost of an artesian well is trifling, and it can be bored to any depth as iron tubes are inserted, and as soon as the spring is reached the water flows spontaneously. In the south of France there are artesian wells from 1,000 to 1,500 feet in depth, but in India, I think, the springs generally range from 80 to 100 feet at most. The cost of the borer can be ascertained, as one borer can execute as many wells as are needed, and I think its introduction into India would be an advantage for agricultural purposes.

PHILO.

Allahabad, 3rd June, 1879.

COFFEE AND CACAO PLANTING IN JOHORE.

(To the Editor of the "Daily Times.")

SIR,—I have been much amused by reading Mr. Hill's very interesting reports on the suitability of certain districts in Johore, for coffee, cacao and tea plantations, and the very strong inducements that he holds out to planters and capitalists to go there and make their fortunes. It is to be hoped that capitalists, before embarking in such wild speculations, will first of all be well assured that there are proper seasons in Johore, suitable for the growth of the plants and the flowering and the ripening of their fruit at certain periods, in order to obtain a paying crop regarding which Mr. Hill himself states that he could gain no satisfactory information, and he also further complains of the quantity of rain and prevalence of cloudy weather during his visits to those places, from which it may be inferred that the climate is not adapted to the ripening of coffee or cacao. Does Mr. Hill fancy for a moment that the planting of cacao or coffee has never been experimented on in the Malay Peninsula? I can assure him that it has been tried, not only in the Johore States, but in Penang and Province Wellesley, and in Singapore also many years ago, and has been proved to be unprofitable for the following reasons; coffee or cacao plants require shade, but from there being no regular seasons, the rain, which is uncertain and heavy at times, not only destroys the flowers, but also the young and half-grown fruit. The plants being more or less in flower through the year, there will be found on them berries in all stages of growth, from the fully ripe berry, to the young green fruit and blossoms, all of them on the same branch at one time, which clearly shows that the climate will not answer, and that it will never pay a planter to keep a number of coolies all the year round on his plantation for the purpose of watching and gathering a few ripe berries of coffee and pods of cacao daily.

Singapore, 23rd May, 1879.

Yours sincerely,

AN OLD PLANTER.

THE CULTIVATION AND CROPPING OF THE BAMBOO.

(To the Editor of the Society of Arts Journal.)

SIR,—Dr. King's letter, in your issue of the 18th, is a portion only of one he addressed on the 6th February last to the Calcutta *Englishman*,* I therefore confine myself to requesting you to insert that portion only of my letter replying to his in the same journal, as it is hardly worth while occupying your valuable space to carry on a controversy which, so far as I can see, can tend to no practical issue, as I most certainly, am not desirous that Dr. King (with his expressed views) should be induced to make any further experiments with cropping bamboo.

Dr. King, however, does admit "that young bamboo shoots may, one day, become an article of export from India." This event has occurred somewhat sooner, perhaps, than the doctor anticipated, as I have this week received my first consignment of "young stems" from Burmah, which bear evidence of having been floated (which Dr. King asserts they will not do), the mud contracted in that operation still adhering to them; this I must remove ere I can make them into paper which I propose doing next week; some of these shoots are over 20 feet in length, and 12 inches in circumference, and as regards quality, all I could desire.

On the rafts arriving at Rangoon, the stems were crushed by the rolls I sent out for Government. I must remark, however, that due to their extreme lightness and bulk (they have cost me 40s. per ton carriage from Liverpool alone), it is clear that the export of raw bamboos from India can never develop into a trade; they must be converted into "stock" where grown or produced.

THOMAS ROUTLEDGE.

Claxheugh, Sunderland, 23rd April, 1879.

THICK *VERSUS* THIN SOWING.

(To the Editor of the "North British Agriculturist.")

SIR,—I am glad to see a letter from Mr. Mechi on thick and thin sowing in your columns. I have visited Mr. Mechi's farm and have read all, or nearly all, his sayings on matters agricultural, and there is no farmer for whom I entertain a higher respect, or who I believe has done more for British agriculture, than the hospitable, frank, and outspoken, true old English gentleman who is owner of Tiptree Hall.

I have, however, long been in doubt whether his advocacy of thin sowing, based chiefly upon opinion, is quite proper; for I think his experiments begin and end with the trial of two pecks of wheat per acre. I have also very considerable doubts whether his theory that seeds ought to produce forty for one, will settle the question of the comparative profit from thick or thin sowing. I quite admit if returns for the quantity of seed sown is the test, the thin sowing has it. The cost of the seed is, however, only a fraction of the expense of cultivating a grain crop. I have seen a good crop of wheat grown from one peck of seed per acre; but the risk of failure is great, and were we to sow so little as even eight pecks on our soils here, the result would often be no crop at all; between worms, slugs, and grubs, it would at times disappear altogether. Although it is possible to have wheat too thick, I often witness enormous areas of wheat, both in England and Scotland that ought to have been ploughed up from being too thin. Mr. Mechi mentions his average yield of wheat in 1868. I had no wheat in that year, but had to resow twelve acres of oats, which had been completely destroyed by the grub worm. My wheat for the last five years has averaged 48 bushels per acre, while my returns of oats are larger than those grown on Tiptree Hall. The quantities I mentioned were sown per imperial acre—the Scotch acre has been obsolete here ever since I remember. I made for three years in succession very careful experiments on oats, and found in every experiment, and in each year, the heaviest and best crop both of straw and grain was produced by very thick seeding; and I have not seen any experiments, equally carefully made, which contradict the results I obtained. Nor could the results have been due to our cold climate, for each of the years in which the experiments were made—1868, '69, '70—were beyond average, warm and dry; indeed the climate of Aberdeenshire in these years would be quite equal to the climate of Essex in an average season. Neither could it have been owing to inferiority of soil, for some of the plots yielded over 10 quarters per imperial acre. The quantity of oats grown per acre on any particular farm, however, does not settle the question of thick or thin sowing; neither, to my mind, does the mere opinions of our best practical men. For I have seen not a few popular agricultural beliefs weighed in the balance and found wanting, and therefore I am quite sceptical where opinions are unsupported by experiments. What we require in Scotland, and I think in England too, is that the National or other Agricultural Societies take up this important question, and make, not one experiment, but a series of experiments, in different soils and seasons, so as to set the question at rest.

JOHN MILNE.

Mains of Laithers, Turriff, 21st April, 1879.

* NOTE.—See our issue of 2nd June last p. 124.

CULTIVATION OF FRUITS.

(To the Editor "Madras Athenæum.")

SIR,—Some time ago you were advocating in your paper the study of agriculture by educated natives. In connection with this subject there is a point I should be glad to see you take up and discuss thoroughly, and that is the cultivation of fruits. In the old gardens in and around Madras there are still to be seen some grand old mango trees, but I am sorry to say that so far as my experience goes, and it is a pretty wide one, many of the native owners pay little attention to their preservation and cultivation. I see no young grafted mango trees being planted but I see the existing trees neglected. The well-grown Petre mango is, in my humble opinion, one of the finest fruits in the world, and it appears to me to be a sad misfortune that it is not more largely cultivated. Take the old gardens out at Koodoombaukum. There are some grand trees there which are simply going to ruin. They are never pruned, never manured, never cared for, except in crop time, when they are let out to the purchaser who will pay the highest price for what crop there may be. What I want to know is where are mangoes to come from in future years if new gardens be not opened? This is one of the subjects that the Horticultural Society should take up. The society has a good deal of influence and if it would turn its attention to this matter, every compound in Madras would in a few years be graced by flourishing young grafted mango trees. If our predecessors planted the trees from which we now obtain this delicious fruit, it is our duty to our successors that we should leave them at least as good an inheritance as that which has come down to us. My advice to all house owners is to plant mango trees in their compounds. Some years must elapse before they will yield a fair crop, but the fact of the trees being planted will tend to enhance the value of gardens where they are planted. As the natives do not seem to care to plant these trees, let all Europeans do so. Those who come after us will remember us the more gratefully.

MANGOES.

WELL IRRIGATION IN SARUN.

(To the Editor of the "Englishman.")

SIR,—In reply to your correspondent D. N. R.'s letter on the subject of well irrigation in Sarun, I desire to draw attention to the apparently fair, but in reality most misguiding comparison he makes by comparing the produce during the six years from 1873-74 (since when Mr. Tytler's wells began to exert their influence) to 1878-79, against the six preceding years, *viz.*:—1867-68 to 1872-73. Had no extraordinary circumstances arisen during the latter period, the comparison would have been of great use and a good test, but D. N. R. omits to mention that in 1877-78, the poppy crop was suddenly destroyed by blight of the most virulent type. In that year, up to the commencement of February, when the poppy was almost in flower, a first class crop was on the ground, but without warning in ten days it was nearly entirely destroyed by the devastating action of the poppy mould, *Peronospora arborescens*, which is closely allied to *Peronospora infestans*, the potato blight, that in 1845, as every one knows, completely destroyed the potato crop in Ireland. About the beginning of February last year the cultivators expected a full crop, and Mr. Tytler himself estimated the promised outturn at not less than 7,000 maunds, or about 6 seers 4 chittacks per bigah. The public will realise the intensity of the disaster when it is known that only 1,495 maunds remained.

What the present year has been, may be best judged from D. N. R.'s own description of it, as "a most disastrous season," At the present time no rain has fallen for more than eight months in Sewan except three petty showers at long intervals, varying from a quarter to a half inch fall. In fact, the drought in Sewan has been beyond all precedent within the memory of even the oldest cultivators. But for well irrigation it would have been almost impossible to hope for any kind of poppy crop. Mr. Tytler distinctly states that the number of wells he has made is only *half* of what is requisite to secure the whole crop of his sub-division.

In the present year, Mr. Tytler has obtained about 3,150 maunds or almost exactly *one-half* of the total outturn of his sub-division in a prosperous year. In fact, I regard the results of the present season as being the most conclusive evidence of the vital importance of Mr. Tytler's system of well irrigation. Moreover, a considerable part of this year's crop failed because it was grown from the blighted seed of

1877-78. In short, Mr. Tytler's wells have *saved* whatever has escaped the ruin of blight and drought.

If a fair comparison is desired, the four years preceding the blight should be compared with the four years immediately preceding those in which Mr. Tytler's wells came into existence as in the following table :—

		Cultivation in bigahs.	Produce in maunds.	Average per bigah. s. c. k.
Prior to the existence of wells.	1869-70	46,959	7,256 19 12	6 8 0
	1870-71	47,742	4,046 11 6	4 2 1
	1871-72	48,068	4,429 0 6	3 11 0
	1872-73	44,378	4,876 36 0	4 6 1
After the wells came into use.	1873-74	41,596	5,567 37 13	5 5 3
	1874-75	44,772	6,504 35 2	5 13 0
	1875-76	44,026	6,749 5 0	6 2 0
	1876-77	45,671	7,202 27 4	6 4 3

The steady high average of produce per bigah since the wells have been made is very marked as compared with the spasmodic yields of former seasons.

All the opium districts north of the Ganges have almost exactly similar soils, and fair comparison can again be made between them (though such cannot be effected between the districts north and south of the Ganges, owing to the superior soils in the latter tracts). The following comparative statement shews the average per bigah in the six opium districts north of the Ganges from 1873-74 (the beginning of the wells) to 1876-77 :—

Seasons.	Sewan.	Chupra.	Bettiah.	Motihari.	Tirhoot.	Hajipur.
	s. c. k.	s. c. k.	s. c. k.	s. c. k.	s. c. k.	s. c. k.
1873-74	5 5 3	5 15 0	3 10 3	3 7 0	4 6 1	6 14 1
1874-75	5 13 0	4 12 2	5 8 3	3 15 2	3 3 1	4 4 0
1875-76	6 2 0	5 11 3	3 15 3	3 8 3	3 11 2	5 8 1
1876-77	6 4 3	5 10 2	4 5 3	4 8 0	4 2 1	5 6 0

It must be allowed that Mr. Tytler's district compares favorably in yield during these years with the others. In fact, in 1874-75 his average was better than in any other district in the whole of the Behar agency, including the superior opium producing districts south of the Ganges—a distinction no other sub-agency north of the Ganges could previously claim. In 1876-77 he gained a similar success with 6 seers 4 chittacks to the bigah, Arrah coming second with 5 seers 10 chittacks.

It has been Mr. Tytler's misfortune to have the completion of his successful scheme temporarily frustrated by such unprecedented and unforeseen calamities.

As to D.N.R.'s assertion that neither opium, sugarcane, or tobacco, benefit the ryot, it must be admitted that he has always shewn himself in pamphlet and letter the steady depreciator of those valuable, and to the ryot, most paying crops which contend with indigo for the possession of the most favored soils. No one disapproves more of his persistent enmity to those crops than his fellow planters, for none know better than they that it is poppy and sugarcane and tobacco and rice that pay the rent in the villages they hold in lease.

C. J. W. D.

KOTEGHUR NOTES.

SIR,—This month has been very dry, for although we have had eight days on which rain fell, yet the quantity has been so slight that it has not penetrated the ground more than a quarter of an inch on any occasion. Of hail we have had nothing to speak of.

The following is a comparative table of the past five seasons :—

1875.	1876.	1877.	1878.	1879.
*3	6	3	1	1
†18	4	13	16	8
Wet, hot, steamy and close ; especially in the evenings.	Dry. Barley and wheat unexampled for their abundance.	Wet at the beginning of the month. Thunder and lightning in the afternoons. Barley partially destroyed by the hail.	Wet and cold month, retarding ripening of the crops. Thunder and lightning frequent and severe. Hail heavy.	Very dry, only light showers have fallen. Barley and wheat partially burnt up with the heat. Hail slight.

* Haily days. † [illegible]

Wind generally in the west, especially towards afternoon and evening, reaching its maximum about 4 o'clock and then gradually lessening till it ceased soon after sunset. The thunder and lightning have been very slight here ; the higher ranges of Kulu and Bissahir getting the benefit. The weather has been hazy as usual, especially towards the afternoons : this haze is very depressing to the spirits—sitting upon one like an old man of the mountain—it is the forerunner of the rainy season, and its duration varies, being dependent on the wetness of the previous winter and spring ; if they have been moist the haze then comes on late and we have not to bear with it for so long a time as when those seasons have been dry. The natives believe that after fifteen days of this haze the *chota bursat* comes.

They have also another saying that hail always falls on the anniversary of the national *mâlâ* of the Komarsen people (inhabitants of the adjoining Hill State of that name), *i.e.*, on or about the 13th of this month, and although it did not hail on that particular day this year, yet it did so within a very few hours, as it fell on the following morning.

The thermometer (Fht.), hung in an open verandah, W. aspect, is about 64° in the morning, 71° in the evening ; lowest 56°, highest 78°.

Young female cones of the *Abies smithiana* (vern. *rai*) now form the male catkins came out last month. Male cones of the *Pinus excelsa* (vern. *kail*) now out. The male catkins of the yew were out last month, and the female flowers—resembling leaf-buds, but in colour yellow instead of green—are now out. Wild roses (vern. *kui*) pink and white are now out in wild profusion ; they are great climbers and a pine or other tree covered with them (the white ones) presents, at a distance, the appearance of the silver rain produced by pyrotechnists. The wild jasmine, with its pretty white flowers, is out. The white *potentilla* is forming its fruit, and the unwary are frequently deluded into picking and eating it under the belief that it is a strawberry, which in outward appearance it strongly resembles, though in taste it is very unpleasant. Raspberries are ripe and taste pleasant. The blue larkspur and white lily of the valley are in blossom ; thistles also. The clematis has ceased blossoming.

Young monaul, kalij, koklas, and cheer, are now being hatched. Martins are still sitting on their eggs. I find that monauls have been reared in the Zoological gardens in London, but I do not recollect hearing with what success. Fire-flies and musquitos in plenty.

Food grains are about the same, and the prices will not be allowed to drop, if the Government officials here—who are also large landowners—can prevent such an occurrence. This season's barley harvest commenced on the 10th , the crop may be considered a thirteen anna one at this elevation, and above us, though in the valley the outturn will not have been so much.

The wheat crop will be below the average owing to the drought of the past winter and spring : I should feel inclined to estimate it at an eleven anna crop, sufficient, however, to tide over till the autumn harvest.

The villagers have been extracting the juice from the opium plants ; for this purpose they use a small iron instrument called a *nerna* (a four-bladed lancet), to make an incision in the *dodi* (capsule), which operation is performed over-night so as to allow time for the juice to ooze out and become slightly coagulated before it is removed the next morning, when the villagers go the round of the plants and scrape it off with a *loon* (blunt blade) ; it is collected on its own leaves—about a dozen together—as they prevent it from drying and losing in weight. The juice is then made up into little balls, *petki*, and placed between fresh leaves in an earthen vessel and kept there till a sufficient quantity has been collected for sale. I ought to have mentioned that the incisions are made diagonally to prevent the juice from running down and so being lost.

In the valley rice seed has been sown in the nurseries, and already some of them are presenting a brilliant emerald appearance from the young green blades of the sprouting rice.

Hill potatoes are sprouting.

Apricots are turning yellow, and will soon be fit *for the table. Plums, quinces, peaches, grapes, apples (poor in quantity and quality),* walnuts are looking fairly promising, though not so well as in previous seasons.

In the garden we have the passion-flower in blossom in all its glory it received its name from a fancied resemblance in the flowers to the appearances presented at Calvary ; in the five anthers the old monks saw a resemblance to the wounds of Christ, in the triple style the three nails on the cross, in the central gynophore the pillar of the cross, and in the filamentous processes the rays of light around the Saviour, or the crown of thorns. Then there are carnations, cornflowers, pinks, balsams, heartsease, lupins, lilies, nasturtiums, and sweet peas, the latter just going out of bloom. Roses in abundance.

Of vegetables we are having mustard and cress, peas, beans, lettuces, water-cress, carrots, parsley, radishes ; while in course of growth there are turnips, beet, cabbages, onions, tomatoes, sage, thyme.

Koteghur, May 31st 1879. G. P. P.

The Indian Agriculturist.

CALCUTTA, JULY 1, 1879.

COMPOSITION AND RELATION OF PLANTS AND SOILS.

When a portion of soil is exposed to a red heat it is found to be composed of two parts, a part that is combustible, and a part which, with ordinary heat, you cannot burn. Any plant subjected to heat gives the same results, with this difference, that in the case of the plant by far the larger part is driven off in the burning. In the soil, but a small portion indeed, of the whole, is so acted on; rarely exceeding 8 or 10 per cent., often falling much below this. This organic combustible matter exists in the soil, in that part of it which the older agricultural authorities spoke of under the name of humus, carried to it by various agencies, such as falling rain, dew, and decaying vegetation. Humus is neither more nor less than the decomposed or decomposing vegetable matter (roots, leaves, stems) which is always found in soils wherever there is vegetation. It is never found elsewhere than on the surface, where plants are growing, or where they have previously flourished and decayed. The quantity and quality of the humus is mainly dependant on the vegetation which now covers, or has covered, the soil. The analysis of humus (proximate analysis) yields chiefly :—

Ulmic acid	...	$C_{40}\ H_{18}\ O_{16}$
Humic „	...	$C_{40}\ H_{16}\ O_{16}$
Crenic „	...	$C_{24}\ H_{12}\ O_{16}$

The greatest bulk of every plant consists of a substance called cellulose, the chemical formula for which is sometimes given as follows :—$C_6\ H_{10}\ O_5$.

The close resemblance between these formulæ, the increase of oxygen and the decrease of hydrogen point to the fact that humus must have been produced by the gradual decay of cellulose. At one time chemists, and at the present day, many agriculturists, attribute the fertility of the soil chiefly to the humus. Vegetation, they hold derives its chief organic constituents mainly from the humus. It is now generally admitted that humus is not a direct source of organic instrument. It is only so when the gradual decomposition of the humus yields carbonic acid, and not in any other sense. It would not be difficult to prove, that the carbon of plants cannot exclusively be derived from the humus, for then the whole vegetation grown on a soil would require to be returned to the soil in order to provide sufficient natural food for the succeeding generation of plants. This is not the case, for the burning of fuel, and the assimilative power of animals are continually changing immense quantities of vegetable matter into carbonic acid and other compounds, and if humus were the only source of carbon, then vegetation would gradually diminish and at last become extinct. Schleiden has calculated, that this would be effected in sixty years. Boussingault has also demonstrated that the crop reared on an acre of land removes on an average one ton of organic matter more than is put into the soil by manure ; and this is accomplished without any decrease of the humus. Humboldt also states, that an acre of bananas yields 152,000lbs. weight of fruit, containing 14 tons of carbon, and this rate of yield can be continued for 20 years, so that in that time 280 tons of carbon would be obtained in this way ; but it could not be obtained from the soil, because an acre of land weighing 1,000 tons, and containing 4 per cent. of humus, could not yield more than 20 tons.

Boussingault sowed peas weighing 15·60 grains in a soil exclusively composed of sand and clay which had been raised to a red heat, and could, therefore, contain no humus, no organic matter. He found after 99 days growth, that the crop weighed 68·72 grains, showing a four-fold increase. No rain water was allowed to reach the crop, it was supplied with water which had previously been distilled. These and other experiments of a similar kind prove, that the humus cannot be the only source of the carbon of plants, but that on the other hand the carbon dioxide of the air is its chief source.

The other organic substances in the plant we shall have occasion to deal with when we come to speak of the other sources whence plants derive their food ; but after the soil has been subjected to a red heat, what we have remaining is mineral matter only, the material of which rocks are chiefly composed. Varieties of soil then are due to the rocks which compose them. All fertile soils would remain fertile if the crop grown on them were returned to the soil. A soil rapidly becomes sterile or unproductive if crops are continuously taken from it without returning to the soil, in some form, the mineral matters removed by the crop. The illustrations that rise to our memory are the pasture lands of Cheshire, which had been rendered all but useless for dairy purposes because of a neglect of this well established fact. The Southern States of America are also well-known to have yielded for many years cotton and tobacco, until at last a paying crop could not be raised without the use of manures. There is an exhaustless supply of mineral food locked up in the soil, a certain portion of which, however, is only available at a time. The rest lies locked up, waiting to be liberated by the slow processes of disintegration and decay ; and the other chemical and mechanical influences that are always at work. If all the potash be removed from a soil by successive cropping of the same class of plants that require potash for their maturing, then no profitable crop of a similar class of plants can be raised, however abundant the other mineral foods of the soil may be until one of two things happens, 1st. either potash be restored to the soil in sufficient abundance to suit the need of the crop; or 2nd till the natural influences, ever at work, in the course of time liberate sufficient to produce a paying crop. The difference between what have been called the dormant and active constituents of the soil cannot be too frequently insisted on. A chemical analysis of a soil to be of the greatest practical use should make a clear distinction between these constituents. It, is not enough for the farmer to know what substances are present and which absent, he should also have a more or less accurate calculation of the mineral matters in the soil that are soluble in water, that is *active*, and ready to enter a plant as food, and those which are insoluble, that is *dormant*, and incapable in their present form of becoming plant food. The fertility of a soil depends, not only on its colour, slope, shelter, the absence or presence of a good subsoil, the state of disintegration of its particles, its porousness, its power, of retaining, or evaporating moisture, and the presence in it of those substances indispensable to the perfect growth of plants, but as we have said those mineral constituents must be in an active state, soluble, ready to enter and build up the structure of plants. An accurate acquaintance with the ash constituents of crops and the relative quantities of each substance removed from the soil by each crop, this, taken in conjunction with a knowledge of the active and dormant constituents of the soil on which the crops are grown, these two factors lie at the very foundation of all intelligent farming ; and on which are built up all that mass of facts and inductions which has raised agriculture from the depths of ignorance and empiricism to the dignity of one of the exact sciences.

If any plant be burned it will be found that after combustion nothing is left but a little ash, and this ash bears but a small proportion to the whole plant. Estimating the ash roughly, we may say that it composes 4 per cent. of the whole, and this ash consists exclusively of mineral or in organic matter, such as potash, soda, lime, magnesia, silica, oxides of iron, phosphoric and sulphuric acids, chlorine, and more rarely, manganese, iodine, bromine and fluorine. In the living plant probably none of these substances are to be found uncombined or free, they are usually in the form of compounds, more or less complex, and varied in their properties and composition. Almost all classes of plants are distinguished by the presence of certain acids, corn plants contain silicic acid—these do not always exist in a free state, they are usually combined with some alkali, such as potash, or soda, forming silicates of potash, and oxalates of potash, soda or lime.

The larger part of the plant that disappears in the burning consisting of about 96 per cent. of the whole is composed almost entirely of four elements, sometimes called organic elements, *viz.*, hydrogen, oxygen, carbon and nitrogen. The living plant obtains its carbon from carbon dioxide, its hydrogen and

oxygen from water, and its nitrogen and, perhaps, some of its oxygen from the air. Nitrogen is present in plants in very small quantities and only in certain parts, chiefly the seed. By far the greatest bulk of every plant consists of a substance called cellulose, it is found nearly pure in the pith of plants and in the hairs of cotton. Treated with sulphuric acid it is converted first into dextrine, and afterwards into grape-sugar, the combined action of sulphuric and nitric acids changes it into gun-cotton; and a solution of this in alcohol is known as collodion, and is used by surgeons in protecting ulcerated surfaces from the air. Starch, gum, cane-sugar, and grape-sugar are in reality different forms of cellulose in which the proportion between the three elements, oxygen, hydrogen, and carbon are varied. There are only four combinations of these organic elements which can be used by plants as food—they are water, H_2O, carbon-dioxide, CO_2, ammonia, NH_3, and nitric acid, NO_3. The second supplies carbon, the third supplies hydrogen and the third and fourth nitrogen, all others may supply oxygen. It has already been noted, that all of these four compounds are present in the atmosphere. The water is evaporated by the sun's heat, the carbon-dioxide is derived from the lungs of animals and from fires and volcanoes, the ammonia from the disintegration of organic compounds, and the oxides of nitrogen from electric action and organic decomposition.

The organic matter which forms, as we have said, by far the larger part of every plant, is usually grouped under two classes of compounds, *viz.*, those containing nitrogen, and those into whose composition nitrogen does not enter. The former are frequently called proteids and the latter amalyoids. This division of the organic compounds of plants is a very important one, for it gives us in reality a proximate classification of those substance which, used as food, are sometimes characterized as fat-formers and flesh-formers.

The proximate composition of the organic part of all plants is as follows:—

Amalyoids or Starches.	*(Proteids or Albuminoids.)*
Cellulose and wood fibre	(Vegetable) albumen
Starch	Gluten (fibrin)
Gum	Legumin (casein)
Sugar	
Oil	

The substances enumerated under amalyoids are of themselves quite insufficient to support life. They are totally deficient in nitrogen, without which the waste of the body cannot be repaired. Children fed only on arrowroot, sago or any other starchy substances, natural or artificial, will die of slow starvation as surely as if food were altogether withheld. Hence all starch foods should be mingled with some others containing nitrogen and other mineral substances such as lime, phosphorous, &c., necessary to build up the body. In nature we find this mixture, notably in milk, grasses, oats, wheat and barley, and all leguminous plants.

Plants then obtain the materials of which they are composed, organic and inorganic, and which they elaborate and build up within their own organism into those various substances already enumerated, from three sources, *viz.*, water, the atmosphere and the soil. In their turn plants become the food of animals. In the bodies of the latter, the materials drawn from the inorganic world, the soil, the air, and water, are further elaborated, and used to build up and repair the waste of their bodies. In process of time, disease and death break up and disintegrate the bodies of animals. Their bones become carbonate and phosphate of lime, their muscles and viscera and nervous system in the long run become carbon-dioxide, ammonia, and water, these mingle with the soil and the air; and are again ready to enter plants as food, and begin the same great round of absorption, elaboration and disintegration. This, shortly stated, is the great round of nature, the continual building up of life and all that it implies from inorganic matter; and the as constant return of the organised structure to the inorganic. Here there is no loss, only change, the invisible becoming the tangible; the inorganic the organic, the matter of the dead material world entering into and building up the world of life, thought and action, each particle of matter playing, in the great drama of existence, many parts, and outrivaling in multiplicity and diversity of change the wildest dreams of eastern metempsychosis.

ANGLO-INDIANS AND AGRICULTURE.

THE possible future of the Eurasian community has, on more occasions than one, engaged the attention of public men and been the theme of public comment at frequently recurring intervals. This is one of those subjects that seem to turn up periodically, to flash across the zenith of official and public notice and to disappear below the horizon, crowded out of sight by every-day recurring events. The large body of Eurasians are gentlemen in tastes, habits and education, and whatever they may be as a class, have as individuals, rendered yeoman's service to India. They occupy positions of trust and authority in every department of the public service. There can be, we think, however, no doubt, that, from various causes, there are not the same ready outlets for employment and occupation now-a-days, that there have been in the days that are gone by; and one reason for this is, that a greater number of suitable candidates for office and employment in the public service and in mercantile firms are now available, than say twenty years ago. Natives, both Mahomedans and Hindoos, have found that an English education is the passport to, in many cases, remunerative and permanent occupations, which were perhaps to a great extent, sought after by Eurasians. There are many positions in the service of Government which are now attainable only by undergoing a course of education and an examination which practically exclude all, whether Natives or Eurasians who cannot proceed to England and avail themselves of the advantages to be gained by a sojourn there; this as we have said, practically excludes all but the comparatively wealthy; and those who are fortunate enough to secure the few scholarships that are available for such a purpose. We have then a higher standard of educational fitness and a larger and more varied number of men seeking for posts which have not increased in number in the same ratio; and day by day we are being brought nearer the problem of how to provide an outlet, a suitable outlet for whatever skill, energy, and intellect there may be in the Eurasian and Native communities.

It seems to us that agriculture, the developing of the great natural resources and products of the soil of India, has not received that due attention and consideration from the Anglo Indian community which its importance deserves. There is, we believe, a permanent source of wealth and prosperity lying locked up in the soil, waiting to be released by willing hands and skilful brains and moderate capital. The most that Government can be expected to do in this matter is to provide agricultural colleges,—somewhat after the model of Cirencester College, Aspatria Agricultural School, and similar institutions in England, where theory and practice to a great extent go hand in hand,—in order that the principles at least of agriculture may be efficiently taught, and in the college grounds practically illustrated. The attention of the Government to agriculture has for many reasons been fitful and not always either economical or successful or wisely considered but agricultural colleges in every presidency, brought into intimate relationship with the lower and middle class schools of the country by means of judiciously established scholarships so as to secure the likeliest lads from rural districts, who would return to their homes and the occupation of their fathers with ideas and methods of culture and a knowledge of the fundamental principles of farming, would in the course of a very few years, work out for the ryots of India more than all the legislation that has been since the English rule began. We are not however, at present so much concerned with the duties of Government in this matter tardy, intermittent, and it may be wasteful, though well intended its action may have been, as with the great possibilities for the future, that lie in the adopting of agriculture as a profession by educated Eurasians and Anglo-Indians.

Bengal is as near as may be over-run with briefless barristers and men with university educations and degrees, they cannot all be Government servants, or teachers, or mercantile assistants. If they cannot, with all their college training, secure a living, the sooner they turn their attention to some other possibility of providing for their daily wants, the better for themselves and India. Agriculture, we believe, has advantages as a calling, which has not as yet been realized by many in this strait. Little good we think will come of knocking at the doors of departments, memorializing Government to help them in schemes of emigration, &c

fulminating against the freaks, and it may be the new policy of departmental heads. "God helps those who help themselves." Cut out for themselves a career of their own, distasteful though in anticipation it may appear, and freighted with hard work: the future will bring its own rewards of modest independence and usefulness. There is a very wide field for labour, usefulness, and profit to all who care to enter on it, in a wisely considered endeavour to improve the breeds of cattle, sheep, goats, and poultry, which years of ignorant hap-hazard and starvation management are fast deteriorating. There is wealth and security of capital in spreading it over many bottoms, a variety of crops, and in breeding for the market animals used for food in the great presidency towns, so that if one crop fails or one venture be unsuccessful, the others may tide over the difficulty. It is quite true that a life devoted to agriculture implies a renunciation of much of the social enjoyments, amusements, and comforts of a town life; but a few men clubbing their modest capital and cultured intellects; and giving themselves each to special duties in the management of their affairs, one to the management of the land, another to the preparing of animals for the market, a third to the sale of produce, cattle, &c., and the general business arrangements and requirements of the farm, would find in the long run an honourable and lucrative occupation, and would raise up all over the country a standard of methods and procedure to be followed by the better class of ryots, and ultimately bring about what the permanent settlement has signally failed to do, namely, a cultured class of men, themselves engaged in working and intimately acquainted with land, standing at the head of the agricultural community, and bearing some such relation to it as the squires and gentleman-farmers of England bear to the soil of Britain.

EDITORIAL NOTES.

The British Burmah *Gazette* contains the report by the Deputy Commissioner, Amherst, to the Commissioner of the Tenasserim division, of the Agricultural Show held at Moulmein on the 20th March, and which, in spite of short notice, seems to have been a success. There were prizes given ranging from Rs. 5 to 30, and aggregating Rs. 550; and we find that the leading Europeans of the district contributed to the general fund, while Government gave Rs. 650, and the richer Asiatics gave their quota willingly in the shape of gratuitous refreshments to all-comers.

The Show was not got up in an ambitious spirit, and this was wise, as grand affairs, like exhibitions usually, repel the poorer class of ryots; they are afraid to come and exhibit before so many grand and great people. We strongly recommend this system to the authorities. Such a Show cannot fail to do good, when a farmer with his own eyes saw a brother ryot getting Rs. 30 for shewing the best sample of cleaned rice, he must have felt that there was something real about the affair, and although he may not understand the morale of the system, he will know that if he produces and exhibits the best grain, &c., he will get some prizes of a substantial nature, and he will find out in a secondary manner that his improved grain realises more for him in the bazar—*this* is the ultimate advantage aimed at. We think it would be a good plan to scatter broadcast in the district where these shows are held, and immediately after the exhibition, slips in the vernacular, containing list of prizes, with names and addresses of those who have obtained them. Thousands do not go to the Show, but by this means, they would learn what was going on, and a little personal enquiry would enable them to verify the correctness of the list. This they would be sure to do, as the ryot is a very suspicious individual.

We have before us Colonel Beddome's report dated 10th March 1879, on the Teak Forests of Burmah, and it would seem that there too, that recklessness which has characterized our treatment of growing timber all over the country has been felt very strongly. There seems to be no teak in British Burmah, except those young plantations which are at present under the care of the Forest Department, and which must not be touched for a great many years. The large exports of teak from Moulmein are now brought down from the Shan States of Siam, and those from Rangoon are principally supplied from Upper Burmah.

A large grass grows among these plantations, and almost every year this grass is burnt down, during which burning great damage is done to the young teak. These conflagrations are supposed to be the result of accident, but there is little room for doubt, but that they are intentional. When this grass gets to its full height, it is too hard and dry for the cattle to eat. By burning it down, the young grass comes up in great abundance, and the only way we see out of the difficulty is for the Forest Department to prohibit cattle grazing in the forests altogether, and to keep a belt two hundred yards all round them continually cut down, so that no communication from outside fires should affect them. Doubtless the department will lose a little by this, as cattle grazing brings in a fair amount annually, and this would be more than made up by the saving in other directions. The report is written in a popular style, and is very interesting, as well as instructive.

Mr. Robertson reports the failure in cultivating six shoots of Manilla hemp which he had received from the Calcutta Botanical Gardens in July 1877: all died within a few months from drought. He promises giving the plants another trial in August this year; we trust he will succeed, as the Manilla hemp (*Musa textilis*) is a most valuable plant, and would add very much to the value of our exports were we successful in rearing it.

We are afraid that Mr. Robertson's projected experiments with European ploughs will not be successful, not because such ploughs are not the best, but on account of the cost. What we want is a cheap plough, which will not cost much more than the native plough at present in use, and which will turn up the soil to the depth of from 9 to 12 inches. We have just learnt that such a plough is being turned out in the North-West with fair prospect of success, and when the experiments now going on are completed, we shall be able to describe the plough; as the inventor has kindly promised to put us in possession of all details as soon as his experiments warrant him in doing so definitely.

After Dr. Brown's death, another gentleman, a German, if we remember aright, was sent to Burmah to look after tobacco there. Since he went to join his appointment we have not heard of anything being done, and should be glad to learn whether tobacco is succeeding there or not.

Mr. W. R. Robertson, Superintendent of Government Farms, suggests the advisability of altering the time for admitting candidates into the School of Agriculture from 1st September to the 1st of April. The matriculation examinations of the Universities of Bombay and Madras are held in December and the results are not published until February; hence the time of the year at which we open our new classes is inconvenient for candidates who have passed the matriculation examinations. "It is highly desirable to secure as many matriculated candidates as possible. It has been suggested that the admissions to the School of Agriculture should be confined to those who had matriculated. However, I think that it will be best for the present at any rate to leave the rules as they are, for, under the present rules, we can, if there are enough matriculated candidates, form the new class entirely of them. The object in fixing the admissions in September was to secure the attendance of the new students at the institution, when agricultural operations were most active, but the improvements recently made on the farm, and that are yet in progress will enable us, in future, I hope, to carry on a good deal of cultivation in the summer months. I propose that no change should be made as regards the admission of a new class in September next, when the course of instruction of the senior class ends. But I think that no admission should be granted in September of 1880, the new class to be admitted on the 1st of April 1881, instead." The Government have sanctioned the change proposed in the season of admission to the School of Agriculture.

It is a strange fact that, however indolent and apathetic the Mysore ryot may be, a shower of rain wakens him up and he goes to work at his fields with vigor. The recent rain was a good soaker, and the two days following saw hundreds of ryots out on their fields, ploughing, all other occupation being put aside. Though the ryots in the vicinity of Bangalore have learned to place great value on heavy manuring, and go to much expense, in many instances, to get good manure for their lands, yet it is strange that not a single English

plough is to be seen at work. The advantages of deep ploughing are admitted by the Gowdahs, when one speaks to on this subject, while not a few of them have seen how those in the Experimental Farm were worked, but there appears to exist a prejudice against these ploughs, which no doubt will be got over in time. One gentleman, who has gone into farming a little way from Bangalore, introduced two English ploughs on his lands, trained his men to working them, and the novelty of the thing attracts a good many ryots. We learn also that two native gentlemen have got English ploughs on their farms, and it is by the aid of such that the prejudice we mentioned above, will in time be broken through. Other landowners might copy the example set them in regard to the English ploughs, as their introduction more generally will really benefit the country and the population.

PROFESSOR CONTEGEAU, of Poitiers, has conducted some experiments, to determine to what degree plants requiring much lime can grow in soils deprived more or less of that substance. He concludes that nature has some mixtures, where one element dominates in the soil, without excluding others, so that calcareous plants find, in apparently hostile soils, the materials necessary for their growth. The more the minerals in a soil are soluble, the less is their presence in large quantities required. He found that sandy soils are the most unfavourable to lime-loving plants. M. Obolin, has drawn attention to the fact that the fracture of the bones of ruminant animals is more frequent where soils are calcareous, than the contrary; which coincides with an excess of lime in the bone. M. Teissier complains that in many surgical operations he finds cicatrization to be retarded, owing to an excess of lime secreted. In the case of rickets, the secretion of phosphate of lime in the urine is very marked, but science is not able to explain if the softening of the bones be due, either to an insufficiency of lime in the food, or to the system being incapable of utilising that substance. In the diseases of diabetes and alcoholism, wounds cicatrize with great difficulty, also due, it is presumed, to the blood being in a poisoned state.

M. BERTHETAL has demonstrated that the presence of oxygen facilitates the fermentation of milk; the greater the surface of the latter is exposed, the sooner will fermentation ensue, hence, the importance of shallow in preference to deep pans for a dairy. Up to 111 degrees Fahrenheit fermentation, increases with temperature; it undergoes no change between this and 125° but from the latter degree upwards, the tendency to fermentation diminishes, until the aptitude ceases; while congealed milk on the other hand retains its fermenting character. The digestive juices aid the fermentation of milk.

MR. C. IRVINE, Oregon :—Writes to the *Journal of Agriculture* :—An experienced peach-grower once told me how to restore very old peach trees to their pristine vigor. I never tried it, but give it here and hope some one will, and report. Expose the roots of the tree thoroughly—hunt out all the grubs and cut them out; then pour hot water over all parts where it may reach worms, then cover over with the dirt from a blacksmith's shop that contains iron filings, &c., abundantly, and re-cover with earth from old chip-yard or other rich dirt. These iron filings are splendid for pear trees as well as peach. Your old tree if now trimmed back will become like unto a young one.

FIVE shillings and sixpence is the cost of growing a bushel of wheat in the Western States of America. Two and sixpence is about the cost in Spain. There is an opening for Spanish trade. But the want of roads or railway conveyance to the coast are the obstructions, and the customs dues are at present, the obstacles.

WHO knows but a new wealth of nitrate of soda may yet come to us from the Affghan valleys? Between Charshuck and the Sharawuk desert, on the road from Candahar to Cabul, the land, although highly cultivated, is covered with nitre and chloride of sodium. "It is wonderful," says a correspondent writing from the spot, "to see the amount of this stuff that there is. Going up to the top of one of the old mirris or forts that lay close to Charshuck, the appearance of the ground for miles appeared as if it were shining white with snow."

MR. H. W. H. Browne, of Vyteri, has submitted to the Board of Revenue, a small sample of manilla hemp, which has been grown and cleaned on his estate. Mr. Browne wants to know if the Government is anxious to develop the hemp industry. Mr. Browne should do with hemp as he does with coffee, and ask merchants in London what they will pay for it.

COMMUNICATED AND SELECTED.

AGRARIAN DISTRESS AND DISCONTENT IN INDIA.

ONE of the most hopeful signs of the times, so far as British India is concerned, is the keen and intelligent interest that is beginning to be evinced by thoughtful men at home in the condition of the agricultural population of this country. It is at last generally recognized that India is really one of the poorest regions on the earth, in proportion to its extent, the variety and natural fertility of its soil, and the frugal habits of the people. We have not far to seek for the causes of a poverty so widespread that it seems incredible to those who have not seriously studied the subject. The soil is undoubtedly productive, but its crops are entirely dependent on a regular and abundant supply of rain, or on artificial irrigation. If the clouds of heaven withhold their moisture at certain periods of the year, the seed does not vegetate, or the young plant withers up, and the land becomes a desolate wilderness. Canals of irrigation may partially avert the worst consequences of drought, but to a very limited extent, for they too depend upon the rivers whose volume of waters is a measure of the amount of rainfall. One great drawback to the success of agricultural industry has been the want of capital and the hereditary ignorance of the cultivators. Improvements of any kind have been quite out of the question. The soil has been impoverished from year to year. It is seldom allowed to lie fallow—it is never manured. As it was worked by them of the olden time, so is it worked by the present generation, but with ever increasing difficulty. For one thing, since waste lands have been so largely reclaimed, fewer cattle are kept, and since fuel has become scarce and dear, their droppings are no longer suffered to enrich the ground, but are used to make a fire. Small holdings are also fatal to scientific husbandry. Beyond all this, in consequence of security from invasion and plunder, and of better markets and higher prices, the industrial population, in spite of recurrent famines, has increased to an extent that must cause painful solicitude to the Government, and which threatens to become a positive danger to the State.

The case may not yet be quite so bad as it has been depicted by Miss Nightingale and Mr. Hyndman, who have judged of the whole from a part, and have taken the Deccan ryot as a typical example of the peasantry of all India but it cannot be denied that what Mr. Robert Elliot with excusable exaggeration, calls "the impending bankruptcy of the soil" is a problem of more instant and permanent importance than the rectification of the north-west frontier or the disarmament of the native levies. The question is very fairly discussed in the current number of the *Quarterly Review*, and certain remedies are suggested which might be tried without harm or inconvenience, with the exception of the proposal to reimpose an income-tax. No doubt, a tax upon incomes is theoretically just and equitable, but it is, unhappily, still unsuitable to India, and will ever be so until the moral tone of the middle and lower classes becomes more healthy. The Reviewer cannot, however, be gainsaid where he remarks that "the cultivators contribute the largest and most elastic portion of the financial resources of the empire, and that without their passive obedience the task of ruling India would be beyond our power." It therefore follows, as a logical sequence, that "the increase of agrarian discontent is a matter of the highest political as well as economic consideration." With our imperfect knowledge of the social history of India previous to the British era, it would be presumptuous to affirm that agrarian disturbances never occurred under the Mussulman dynasties, but the phenomenon must have been both rare and insignificant, and in any case we may be quite sure that any disorders of that kind would have been speedily suppressed, and with unmeasured severity. Under British rule, the "dumb masses" gave their first sign of discontent in the uprising of the ryots, ostensibly directed against the money-lenders, but virtually protesting against the harsh procedure of our civil courts. In the days of the Great Moghul, nobles of the highest rank were frequently deprived of their estates at the caprice of the Emperor, but eviction by reason of indebtedness is an innovation of British origin, the practical justice of which has not yet been properly appreciated by the natives. During the Bengal Mutiny, it was no uncommon thing for dispossessed proprietors to return to the lands from which they had been ousted by law, secure of the sympathy and support of their former tenants and dependents. Eviction in the olden time could not be enforced by creditors because the land was held to belong to the State, the

principle of private right of possession not having then been introduced. It is, however, a natural result of the territorial privileges conferred by British legislation, nor is there any reason why land should not be regarded as an alienable commodity quite as much as beasts of burden, live stock, or farming implements. Though quick enough to avail themselves of the new advantages offered by their British rulers, the natives are conveniently obtuse as to the implied conditions of their improved position. They object to eviction under any circumstances, and the Deccan ryots are again committing acts of violence in defence of what they doubtless consider their natural rights. On the last occasion the disturbances were quelled without much difficulty, but Government was at the same time compelled to acknowledge that the popular discontent was not altogether destitute of foundation. An inquiry was accordingly instituted, and a report presented three years ago, but there the matter rested; and nothing has yet been done to alleviate distress or remove dangerous misconception.

The present generation of ryots are little aware of the intolerable evils from which British beneficence has relieved them, and feel no gratitude for the blessings they have tranquilly inherited. Here and there some white-headed grandsire may mumble tales of torture and persecution, but these are listened to as old-world fables, irrelevant, if entertaining. What is now most forcibly remembered is the brief era of prosperity created by the American civil war, and of which comparatively few availed themselves to work out their deliverance from bondage to the usurer. Their improvidence has wrought its own retribution, and the money-lender is still master of the situation, the sense of dependence being embittered by the recollection of the good times that so speedily flitted by. It may be regretted that no laws can be enacted to limit the amount of usury, but it is obviously impossible to regulate the rate of interest by any other measure than the credit of the borrower. The money-lender is, therefore, rather a necessity than an unqualified evil. As the *Quarterly Reviewer* remarks :—

"The village banker is essential to the social system of the country. At once the purchaser of rural produce and the local agent of the central mercantile firms, alike the village shop-keeper and money-lender, he enables the peasantry to derive full benefit from a good season, and to moderate the oft-recurring disasters of drought and flood. Without his aid the rent could not be realized. His functions in normal times, are most important, but in the abnormal times of famine they are indispensible. Then the banker and shop-keeper is stimulated to double activity in both capacities. He advances from his stores, food, seed, stock, and even money, to the peasantry, who can offer nothing but their credit in return. By relieving the better classes of the community, he lessens the pressure upon the public purse. But he does more than this. He becomes the Government purveyor for the masses who are crowded on the State relief works. Experience has proved the advantage of leaving the transport and distribution of food supplies to private trade. The Government officials give ample notice of their requirements, collect and publish information concerning the markets from which plentiful supplies may be drawn, keep open the arteries of communication, and maintain order and discipline amongst the starving people. But it is the sowcar who spans the gulf which separates want from plenty, and fulfils the functions of distribution which no State agency can perform."

This picture is faithful enough so far as it goes, allowing for occasional touches of the official style of Oriental tinting. That the money-lender in the present condition of the rural population is a necessary evil, we have already admitted; but is it really quite impossible to alter that condition so as to dispense with the costly services of the usurer?

The two prominent causes of the existing distress among the agricultural classes are the smallness of the holdings and the redundancy of the population. The magnificent opportunity of introducing a system of large holdings into this Presidency was afforded by the late famine, but Government is ever so immersed in details that it rarely succeeds in taking a wide view of any question. This will always be the case so long as the Viceroy's Council consists of mere bureaucrats, respectable as heads of departments, but possessing not the slightest knowledge of statesmanship. That opportunity was accordingly lost, but it might still be worth while to encourage the sowcars to parcel out their lands in larger quantities, should they be unwilling to cultivate them on their own account. As regards the increase of population, little can be done until the traditions of superstition have died out, and men have sense and moral courage enough to follow the bent of their own genius, and not that of a distant ancestor. A happy day will it be for India when the starveling son of a starving weaver, boldly migrates to another province of the Empire, and there achieves comfort and competence as an ingenious mechanic, a skilful carpenter, or painstaking husbandman. If caste prejudices be discountenanced in every possible way, many openings will present themselves to the crowded-out ryots, who are now perishing through obstinacy and ignorance. In the meanwhile legislative reforms are urgently needed. A modified bankruptcy act might beneficially supplant the process of eviction. Money would be procurable on easier terms were the Act of Limitation as between native and native extended from three to five or even seven years. Imprisonment for debt should also be abolished as a relic of barbarism, and a general system of conciliation introduced for the advantage of both lender and borrower.—*Madras Mail.*

FARMING IN INDIA.

HIGH farming in England, where the land is owned by private individuals, has been gradually elevated into a science. But the Government of India, who are the largest landlords in the world, have as yet done nothing to improve Indian agriculture in a systematic manner. Even the ablest of our officers in the Revenue Survey and other departments have no knowledge of practical, much less of scientific, agriculture. But the cry about the impoverishment of the land, which is being raised in all parts of India, cannot be ignored much longer. Something must be done to enable India to increase her exports, to pay her way, and to mitigate the distress arising from droughts and famine. Mr. Caird, himself an eminent agriculturist, will in his portion of the report of the Famine Commission, bring the unfortunate condition of Indian agriculture to the attention of English statesmen, but in the report of the Deccan Riots Commission they already possess very valuable material. Some old Anglo-Indians, notably Mr. H. N. Elliot, are also doing what they can in England to treat the question from a common sense point of view. A short time back an interesting paper was read by Mr. Elliot before the East India Association. The picture he drew of the future of Indian agriculture was gloomy enough to provoke a good deal of discussion. But in forming a correct opinion on so large a question as the actual character and condition of the soil of such an extensive country as India, it is necessary to take a very broad view, and to consider the evidence from different parts of the country showing how far the soil has deteriorated lately and how much the peasants have been impoverished.

Mr. Elliot draws his conclusions chiefly from the testimony of Messrs Robertson and Harman, two gentlemen possessed of considerable experience of Indian agriculture, the former as Principal of the Government Agricultural College at Sydapet, and the latter as Superintendent of the Government Experimental Farm at Bangalore. About the end of 1875 the Government of Madras sent Mr. Robertson to report upon the agricultural condition of the district of Coimbatore. Accordingly, Mr. Robertson held a minute examination of the soil of the district, the mode of cultivation, and the general condition of the ryots, and reported on them to Government. Mr. Harman also wrote a similar report on Mysore. The main facts brought to the notice of Government in these two reports are, that of late years a very large absorption into culturable soils has taken place, of pasture lands formerly set apart by the village community for the grazing of cattle; that the clearing of the forests thick with trees, and their conversion into culturable soils, have resulted in a diminished rainfall; and, by depriving the ryots of wood-fuel, has driven them to use cattle-dung as fuel, and thus diminished the resources upon which they depended for manuring their exhausted lands. The result has been that about 75 per cent. of the arable land in some districts has become almost worthless for purposes of cultivation.

Our own Presidency supplies abundant evidence in support of these views. In almost every taluka of the Bombay Presidency the process of breaking up pasture land, and bringing it under the plough, has gone on unchecked for years. Meadows, and grazing lands, known as 'Gairan' in the Deccan and 'Churrahs' in Guzerat, which were religiously set apart by the village communities for the grazing of cattle, have been broken up and turned into culturable soils. The settlement officers have brought this fact exultingly to the notice of Government, who have freely permitted it in the interest of the revenue. With regard to the Deccan, some idea of the extent of land thus taken up may be formed from figures of the acreage under the old and the revised assesements in the following talukas :—

Talukas.	Culturable acres under old assessment.	Culturable acres under new assessment.	Difference being increase of acreage.
Indapur	238,135	270,076	31,941
Sholapur	381,882	433,572	51,690
Bhimthari	190,410	212,703	22,293
Pandarpur	84,273	90,798	6,525
Barsi	248,465	278,509	30,044
Haveli	127,610	146,745	19,135
Pabal	161,240	192,411	31,171
Supa (Petta) ..	147,244	159,227	11,983
Karmala	271,194	299,242	28,048
	1,850,453	2,083,283	232,830

These figures are taken from a Resolution of the Bombay Government, dated 29th October, 1874. Most of the increase shown in the acreage is due to the breaking up of pasture lands. More land brought under the plough might be thought to mean more revenue to Government on the one hand, and larger returns to the cultivator on the other; larger exports from the country, and an accession of wealth to the people. But unluckily the wholesale destruction of meadows, grazing lands, and forests has also destroyed the only resources upon which the Indian ryot depends for restoring the fertility of soil, exhausted by perennial cultivation. For a year or two the new land is found to yield good crops. But the land becomes rapidly exhausted, and the ryot has no means of preventing further deterioration. He has no more pasture land because the land has all been ploughed up. He is compelled to use as fuel what should have been manure, because the clearance of forest reserves has

deprived him of all firewood. Even where forests still exist the new laws are so stringently enforced, that, to take an example, the people who used to make a livelihood by cutting little bundles of wooden tooth-picks and vending them to the natives in the different towns, have been warned to drop their trade. The climate, again, has apparently been rendered hotter and drier through this denudation of the country, and this in its turn has according to most authorities, led to a diminution of the yearly rainfall essential in the production of a good crop. The yield of produce per acre is certainly smaller than it used to be, and the increased quantity of land in the hands of the ryots is really a source of perplexity and poverty. But even a low assessment cannot check this growing deterioration of the soil. We have the distinct authority of survey officers for the change that is taking place in this Presidency. Speaking of Karmala, Lieutenant-Colonel Waddington, the Deccan Superintendent of Survey, observes "that the condition of the people from the inquiries I have made does not show that improvement which might have been fairly expected from the influence of the low rates of assessment and security of life and property which the district has enjoyed during the last thirty years, to say nothing of the advantages derived from the construction of the railway, and the increased price of agricultural produce." Mr. Whitcombe attributes this state of things to the "uncertainty of the rainfall, which renders the people careless in the preparation of their lands, and content to trust to the vicissitudes of the seasons, and also to the fact that *many of the ryots hold more land than their means can enable them to cultivate properly*." The italics are ours. So far then for this Presidency; but what is true of Madras and Bombay is equally true of other parts of India. Speaking of the North-West Provinces, Mr. C. A. Elliot, in one of his Settlement Reports, remarks: "I do not hesitate to say that half of our agricultural population never know from year's end to year's end what it is to have their hunger fully satisfied." In regard to Bengal it is enough to know that the ryot there is described as living in a condition of chronic destitution and complete ignorance. In Oude the cultivator consumes nothing of the produce of his labour but the coarsest grains. This concurrent testimony from all parts of the country would certainly seem to show that the fertility of the Indian soil has everywhere decreased, and that the land tax, is consequently everywhere more onerous than before.

What then are the measures to be adopted? Mr. Elliot very properly suggests that all further breaking up of pasture lands should be at once stopped. We would go a little further and suggest that where the ryot is known to possess more land than he can well manage he should be required to allow that land to lie fallow for a year, or cultivate it only with grass or fodder for the purpose of manure or for the use of cattle, the lands thus lying fallow or used for grass being exempted from assessment, or assessed very lightly. Mr. Elliot recommends the use of Indian salt as a highly valuable manure, from the nitrate of potash, lime, and earthy impurities which it contains. To place this valuable resource within reach of the poor, and at the same time to prevent Government suffering a loss of revenue, he suggests that the salt to be used as manure should be so prepared so as to be unfit for domestic use. At all, or most, salt manufacturing salt pans or depôts, there must be heaps of salt rubbish, which could be offered to the ryots for sale. A central depôt, for instance, at Kharagora or at Matoonga, near Bombay, for the sale of agricultural salt might thus at once earn revenue for the State and afford a valuable means to the ryot for the fertilization of his land. This suggestion is so simple, that Government might well act upon it. But, indeed, the chief value of all Mr. Elliot's suggestions is the ease with which they could be adopted. He does not urge the Government to attempt the introduction of high farming, but only to obey the dictates of common sense. He insists than some restrictions should be placed upon the growth of scourging crops like sugarcane or jute, which exhaust the soil more rapidly than other crops. But we do not see how, under the present system of land tenure, Government could so far interfere with the ryot as to dictate the kind of crop which he should or should not grow, though much *may* be done in the way of pointing out the advantage of manures or of growing certain crops in certain descriptions of soil. When a few simple reforms like this are affected, it may be time to talk of high farming and an improved class of agricultural implements.—*Times of India.*

PRACTICAL FARMING IN INDIA.

WHEN it was first proposed to improve Indian agriculture by force of example, the rudiments of agriculture, of which the Indian ryot is assumed to be ignorant, were set aside as superfluous, and that astonished bucolic was all at once introduced to a style of farming which would have done credit to Mr. Mechi. There were deep and learned disquisitions on subsoils, drainage, levels, &c., delivered for his benefit, which the poor Indian rustic could not comprehend, but his stupefaction was probably not complete until he was invited to use a magnificent English iron plough, drawn by a team of four fat Government cattle. Those who know anything of the economy of Indian agriculture will understand the consternation of the ryot when thus asked to cultivate his paternal acres with an apparatus worth, perhaps, altogether a thousand rupees. The Indian ryot, far from being in a position to invest money in the improvement of his land, is only too happy if his land does not run him into debt. It is necessary for him to practise the sternest economy in what might be called the "luxuries" of farming, and if the country plough, at the cost of a few shillings, can do his work any way at all, it is preferable to use that to paying a few pounds for an English article.

The experimentalists in this direction would have done better to try and improve the native rude tools than to ask the ryots to use European implements. It was the same with all matters connected with Indian agriculture. The instruction of the ryot began at the wrong end. But the error is now recognised, and the proceedings of the Government of India, in the Department of Revenue, Agriculture, and Commerce, dated February 4, 1879, promise more sensible action in the future. The Governor-General, writing in May 1877, is quoted in these proceedings with much force:—"His Excellency in Council is by no means prepared to admit that because it is not necessary at present to teach to the natives on a scientific basis, all the technicalities of the highest farming, there is, therefore, no opening for instruction of a highly useful, if of a more modest kind, adapted to the present educational and agricultural standard of the country. His Excellency in Council is unable to agree with his Honor the Lieutenant-Governor, that the attempts of the Government to teach agriculture to the people have failed everywhere. Where these attempts have failed, as at Poosah, failure has been the result of inefficient management;" and again, "it is not necessary to employ specially qualified agricultural chemists for the purposes contemplated by Government in the establishment of model or experimental farms." The development of agriculture in India must take a practical turn. Departments, or their system of conducting business, are apt to run to correspondence which is totally valueless to the ryot, whatever it may be to the Government printer. The collectors and other districts officers are the men who can best promote the objects of the Government in this matter, and every district in India ought, in our opinion, to have a model farm of its own, where any experience of a practical and profitable character could be brought under the notice of the zemindars. Here, too, the acclimatisation of many valuable foreign plants could be brought about by the judicious distribution of seed; and such industries as are suited to the rustic intelligence might also be readily developed under the favour and the frown of the district collector. Unfortunately, district officers complain of being overworked as it is, and to add to their burdens agricultural returns would be too cruel; but there can be little doubt about a large portion of literary work imposed on district officers being quite superfluous, and if these officers were relieved of some of their endless labours in the statistical line, they might be able to find time for what is much more useful—agriculture and acclimatisation. The Government of India sensibly remark that —"Experimental farms, indeed, when they stand alone, are of comparatively small utility. To be really useful, they should be part of a system of agricultural instruction. They should be attached to a school where sound agricultural instruction is conveyed to the class, and they should be the field for carrying into practice, in the presence of students, the theories of which the reasons have been explained to them in the class-room." But we think the Government of India is still too fond of the "class-room" of theory. It would be preferable in our opinion to have an humble farm where there was plenty of practical, but very little of theoretical instruction, in every district in India, to having a few grand model farms with colleges attached at the presidencies. We do not say the latter do no good; but we hold that the others would do more. The natives have a great deal to learn and unlearn before they can be considered in want of the higher agricultural education, and we are by no means sure that even while the European professor is lecturing upon Indian agriculture his audience do not know more about it practically than he does himself.—*Indian Daily News.*

WHAT IS RATIONAL CULTIVATION?

AT a meeting of the Victoria Agricultural Society, held at Heidelberg, on May 5, 1870, the following paper was read by Mr. Josiah Mitchell, then of the Experimental Farm, now of Skelsmergh-hall, Kyneton. The republication of the paper appears to us to be peculiarly appropriate at a time when the results of "irrational cultivation" have been forced so prominently on public attention—*results against which it will be seen Mr. Mitchell's hearers and readers were distinctly forewarned*:—

Mr. Chairman and Gentlemen,—When the subject of this paper that I am now to have the honour of reading before you was announced at your last quarterly meeting, I believe it gave rise to some merriment in consequence of the word "conversation" having been substituted for the word "cultivation." The mistake, I have no doubt, was entirely owing to my indifferent scribbling, and in no way due to any defect in the sight of your usually sharp and zealous secretary. Such blunders are amusing. But I now, in all sober seriousness, ask the question, what is rational cultivation? and when the subject comes on for discussion I hope—without any question to that effect being asked—that you will afford a good illustration of what is pleasant, profitable, and rational conversation. I am quite aware, however, that the question I have asked may cause many to smile, apart altogether from any transposition of words. For there are a large number

of people who imagine that farming, or the cultivation of plants for the sustenance of men and the higher orders of animals, is a sort of business that anyone having the land may pick up and carry on without the slightest *previous training or education to fit them for it; and as for there being an irrational as well as a rational mode of cultivation*—why, such a thing is *never dreamt of in their philosophy!* "To plough and sow, and reap and mow," in the words of the old song, that, in their opinion, is to be a farmer. Many entertaining this absurd notion of farming are now being "settled" on the land, and, of course, become farmers. But in addition to the class already pointed out, we have also in the country districts a large and ever-increasing number of Australian-born youths, fast growing up to manhood. These young men and boys will learn, whether we take the trouble to teach them or not. Their education, such as it is, relative to agriculture, is going on daily. It is imbibed from the practice they see carried on around them, and in which they are engaged. This being the case, from the nature of our prevailing practice of agriculture, it is much to be feared that those coming men into whose hands the cultivation of the land must fall in the course of time, will also become possessed of the erroneous notion that ploughing, sowing, &c., constitutes the sum total of cultivation. Their fathers, let us hope, they consider rational men; they will therefore naturally conclude that the farm practice carried on by them must be perfectly rational too, even although it may consist of growing "wheat after wheat," or successive grain crops and nothing else. It is in the interests of those two classes, but chiefly the youths, that I have asked the question, What is rational cultivation? Let it not, however, be supposed that those two are the only classes interested in this important question. It affects the interests of the entire community. Yet, strange to say, we drive along, or "go-ahead" as it is termed, at such pace that we have hitherto taken no time to inquire whether the seemingly prosperous course we have been pursuing is a rational one, or only the shortest road to ruin. We are rushing up our social edifice, putting in it, true, a lot of "scamped" work; paying much attention to "schools of design;" to the technical education of the mechanic and the artisan, but with a blind and fatuous disregard as to whether the foundations of the structure are resting on the treacherous sands of avarice and speculation, or on the solid rock of rational agriculture, and honest industry. In all this hurry and hubbub to become a great and wealthy nation, the education of the agriculturist to fit him for carrying out his most important duties in connexion with the State has been left to chance, no one seeming to trouble about it. Farmers themselves have been so intently devout in worshipping the golden calf, and making sacrifice to the god Mammon, that they have had no time to pay due homage to the beautiful but inexorable laws of nature. Yet the labours of the husbandman must be in perfect harmony with those laws, otherwise he cannot hope for continuous success. He is not pursuing a rational system of cultivation. "Nature to man speaks wisdom, and he who most consults her is most wise." We cannot, even in dealing with clods of inert earth, transgress her laws with impunity. True, we have hitherto transgressed her laws, and I am sorry to say, still continue to do so, by pursuing an exhaustive system of cropping—for it cannot be called cultivation. Retribution has already overtaken some, and "worn-out" farms are heard of. However, it is "never too late to mend;" and when all the agricultural societies in the colony have followed the good example set by your patriarchal society—as I hope they soon will do—and constituted themselves farmers' clubs for the discussion of this and kindred subjects affecting the interests and progress of agriculture, then we shall have taken the first grand step in the right path towards rectifying past error, and inaugurating a rational, and, therefore, an enduring system of agriculture. In my remarks on the subject of my paper, I shall in the first place point out what is not rational in our present practice; in the second what rational cultivation is, and in the third place, notice some things that I think would tend to promote it.

In the first place, then, the growth of the same crop year after year on the same land, "wheat after wheat" for instance; the production of successive grain crops without any manure, and with only an occasional bare fallow when the land becomes foul; burning straw instead of converting it into manure by the aid of stock, and restoring it again to the land; the laying down of land to grass after it has been exhausted by the growth of grain—these are some of our practices that are not rational because opposed to the laws of nature—rotation and restitution—which govern the growth of plants and the continued fertility of the soils. Rotation, I have said, is a law of nature that governs the growth of plants; it compels change of soil or situation. No plant will thrive continuously on the same spot. This applies as well to oak and pine forests as it does to wheat, oats, or any of our cultivated crops. The necessity for rotation or change of crop is caused, partly by exhaustion in the soil of elements essential for the healthy growth of the plant, and partly in consequence of the excretory matter thrown off by the roots rendering the soil unfit for its further growth. Yet one plant, by its death and decay from these causes makes the most suitable preparation for the healthy growth of some other plant belonging to a different order. In this way the great globe we inhabit has been converted out of barren rocks into the thing of beauty we now see it, and became fitted for the sustenance of man. It is upon this law that the modern practice of British agriculture is founded, and no system of cultivation can be deemed rational if it does not embrace some rotation of crops. I need only instance the well-known success of wheat grown after peas, beans, or clover to illustrate the advantages of rotation. At one time it was supposed that, by attention to a proper rotation of crops—one crop preparing the ground for another—the armer could go on producing crops without any manure to the end of time. Increased knowledge has dispelled that allusion. We now know that in conjunction with rotation we must also have restitution, or compensation, if we would maintain the fertility of the soil and avoid barrenness. Restitution and rotation should be the watchword, the creed, not merely as a matter of faith, but the every-day practice of all who desire to cultivate rationally. We cannot go on ploughing and sowing, reaping and mowing, taking all away, and giving nothing back to replace the mineral substances removed from the land. We cannot, I say, long continue this system of robbery, even with some sort of rotation, without being brought face to face in the long run with one of these two alternatives—restitution or barrenness. The time, of course, will vary with the quality of the soil, but the end must come. How little this inexorable law of restitution seems to be understood, or, if understood, how much we by pursuing our present exhaustive practice seem to disregard it. Yet it is no light matter, but one fraught with serious consequences to any community where a system of spoliation is carried on, instead of rational cultivation. The other day I met with the following statement bearing on this subject in the leading columns of one of our daily journals, in an article commenting on mining leases. In making a comparison between the charge for a mining lease and the cost of agricultural land, the writer proceeds to say:—"Agricultural land rightly passes at a small charge from the Government into the permanent possession of the cultivator, because by the labour of him and his successors it will continue for generations without number, to yield the prime necessities of life, food and raiment, to the inhabitants of the State—because, in fact, cultivation makes of it the commissariat, without which the State could not exist." Now, this holds good only where rational cultivation is carried on; under an exhaustive system there is absolutely no difference between agriculture and mining. The miner works out his claim, and the farmer works out his farm. The former abstracts the "metallic treasure," wealth's representative, and the latter abstracts by means of his crops, the real wealth of any nation, the fertility or producing power of the soil, thereby destroying "the commissariat, without which the State cannot exist." This is a startling fact; yet our State looks on with indifference at a condition of things that must, in the course of a few years seriously affect its own existence. Nay, not only does the State look with indifference on the present system of spoliation without making any attempt to introduce a more rational one, but it actually, by "settling the people," as we are pleased to call it, on too small portions of land, renders an exhaustive practice compulsory on the part of the poor settler. With the frightful example of America before our eyes, and none of her vast resources in the shape of rich agricultural land at our back, we fail to profit by the lesson. There, in America, such is the distance grain has to be transported over country rendered more or less barren by spoliation that unless the price of wheat rules at from 55s. to 60s. a quarter in Britain, it will not pay the farmer in the "far west," where the work of destruction is still going on, to harvest his crops; and they are allowed to shed on the fields. Nearer home, we read of an exodus of farmers from already exhausted districts of South Australia, coming to Victoria to take the benefit of our recent Land Bill, and, of course, to pursue the same system here that has led to the necessity of their leaving South Australia. But to come home, within our own colony we are told by the *Hamilton Spectator* of farmers in the Western district, who having exhausted their own freeholds are now renting land on a short lease at a high rent for the purpose, no doubt, of carrying on the same exhaustive practice. Meantime they have laid their own farms down to grass to recover the lost fertility. Delusive hope! If it be the mineral constituents of which the soil has been exhausted, there is but one way of restoration, and that is by restitution. However, "the convenience of the arrangement" it is said, "is quite mutual, for the landowner will get a far higher return by letting his land for 15s. to 20s. per acre, than he would by keeping a couple of sheep to the acre, and the tenants will be able to make larger annual gains." From this it would appear that the American system, where "the settler subdues a piece of land, flogs it to death, and abandons the carcass, and then repeats the operation on a new subject," a system that has been condemned by thinking men in all countries, is in full force among us; indeed, some, it would appear, have already managed to compass the death of the first victim, and are seriously setting to at the second. With our "limited area of good agricultural land" this is surely an unwise course to pursue, and must be attended by disastrous results. But then "the landowner gets a far higher return, and the tenant larger annual gains." Here we have the true secret—an insane desire to convert the *fertility of the soil, at all hazards, into* hard cash—to sell the birthright of mankind for a few pieces of glittering ore! Curious anomaly of human law this; we will not allow a poor miserable wretch to destroy his own miserable life, but we make no attempt to prevent the destruction of that which maintains life. With lettings like that in the Western district, and the Government selections of 80 acre lots, how can we expect any attention to be paid to the natural laws of restitution and rotation, or any attempt at rational cultivation?

Having pointed out some of our farm practice which I conceive is not rational, and endeavoured to show you why I think so, I shall now pass on to the question, what is rational cultivation? "The object of farming is gain. Whether an agriculturist grows bread to strengthen man, wine to gladden his heart, oil to make him of cheerful countenance, or opium to poison him; whether his barley be made into wholesome ale or deleterious

gin, he has but one concern—does the cultivation pay"? This being the case, and the object gain, the system that enables the farmer to obtain the largest quantity of healthy produce at the smallest cost, and realise the greatest amount of profit; but—pray you mark this well—"without permanently lessening the fertility of the soil"—any system that will fulfil these conditions may be pronounced a rational system of cultivation. The fertility contained in the soil is the farmer's capital; when he sells his crop he sells part of this capital. If he does not restore to his land, in the shape of manures, the fertilising substances taken away in the crop sold, his land will be permanently so much poorer. He is then living partly on capital instead of on interest alone. This is an erroneous and too common practice. By following it the capital originally contained in the soil is year by year diminished, and the farmer, with dim inishing crops of grain, as a matter of course, obtains less and less of interest—not only, mark you, on the capital in the soil, but also on the capital he employs to work his farm. True, the farmer may by this unwise course of practice, when his land is in its virgin freshness, manage to save some money, but such savings cannot all be regarded as legitimate profit, because he has simply been transferring part of his capital out of the soil into some bank. Should he farm the same land long enough, his bank account will dwindle away again, for "the spoliation of land leads to poverty." Now, by following the opposite—that is, the rational—course and restoring again to the soil annually, in the shape of manures, those elements of fertility carried away in the crops sold off the farm, the farmer will retain his capital in the soil intact, and will always obtain undiminished interest on both the capital in the soil and that employed in working the farm. Does some one inquire—will this rational system, this constant manuring—will it pay? Well, all I can say in reply to such a question is —if it won't, we have no business with the land. Why disturb the squatter? Why destroy his rational and profitable employment of the land in the production of wool and tallow, if we take it only to pursue an exhaustive system that must in the long run end in rendering it useless for cultivation, and unfit even for the production of wool and tallow? The fact is, if we, as farmers, are to continue to cultivate, we must cultivate rationally. It is a case of "Hobson's choice, that or none." We must also make it pay, for that is one of the conditions. How, then, are we to set about it?

It is not my intention to attempt to lay down any course of cropping. Every one must decide this matter for himself according to circumstances, climatic conditions, and local requirements. In one part of the colony it may be dairy stock in conjunction with grain-growing; in another sheep, in a third the purchase of phosphatic manures, and the ploughing in of an occasional crop of green manure. So that it becomes simply impossible to point out any specific course whereby to attain the desired end. But this I may say, that whatever system may be adopted it must be based on the laws of restitution and rotation. In colonial agriculture generally the natural tendency seems to be to begin at the wrong end. Instead of starting from grass and the depasturing of stock, the production of grain is made the starting point. By the continued production of grain alone the land becomes exhausted, and thereby unable to produce grass, except of the most worthless and innutritious description. Now, the rational course would be to start from grass as a basis, and in conjunction with this, through green crops, stock, and manure, advance to grain; then, in the course of any rotation, back again to grass. The laying down of cultivated land to grass after a course of cropping, may be likened to putting it to bed; of course the more comfortable we make it the better it will rest—and consigning it for a time to "nature's sweet restorer, balmy sleep," which, if I may be allowed a slight liberty with poetic diction,

"Swiftly on dewy pinion flies from fields
Of woe, too often cropped with golden grain,
And lights on slopes unruffled by a plough."

The bare fallow is like poking up the fire to make it burn away all the faster. But a green crop put in with plenty of good muck, and fed off on the land, is the true "roast beef of old England," and will be followed by plenty of bread and cheese and beer. As I have said before, if we take care of the grass, the grain will take care of itself. To do this we must take care of the muck, and to get muck we must have stock of some sort. By means of stock the farmer can collect together part of the capital contained in the soil of his grass land, and apply it to his arable land for the time being. By thus concentrating his fertile capital, he will secure a larger and more certain return for his outlay on the labour of cultivation. In this way the fertility of the farm will be made to rotate on the farm itself, along with the rotation of crops, and if restitution is made for loss suffered by produce sold, this system may be carried on to the end of time. The first step, however, towards the initiation of such a course of practice is the sub-division of farms into fields; the next, keeping stock and taking care of the muck; after that, rotation of crops, and last, but most important of all, restitution. Under present circumstances, as regards population and cost of labour, not less than three-fourths of a farm should be under grass, "bush grass" of course in the first instance. The larger the farm the larger should be the proportion of grass land. That a system of rational cultivation will not pay in this colony I deny. The truth in this matter is not left without witnesses. For although an exhaustive practice is the prevailing one, and tenant farmers can hardly be expected to follow any other, yet I know several farmers who cultivate their own freeholds on a rational system, and who make it pay, too. It is also a cheering sign of the times that many are now impressed with the necessity of some change, and anxious to adopt a more enduring system. Spoliation it has been found will not continue to pay. And this brings me to the third part of my subject, in which I promised to notice some things which I think would tend to promote rational cultivation.

First on the list of things that would tend to promote rational agriculture, I will venture to mention farmers' clubs, such as this society has had the honour of introducing to the colony; or, as they might be called, farmers' schools for grown-up pupils,

"Where each by turn is teacher and is taught."

They are the most readily available and practicable means of agricultural education that we have at hand. These clubs and the national shows of the Royal and Highland Societies have done more to advance British agriculture to its present position of high excellence than anything else. They have taught the British farmer to think, and to express his thoughts. I can assure you, although you may not think it, I read with far more interest and profit, the papers and discussions of some of those farmers' clubs in the old country than I do even the Parliamentary debates in our own. Through these clubs, and the agency of the press in diffusing the knowledge gleaned at their meetings, and by that strength which such union gives, the British farmer is fast becoming a power in the State. Instead of being considered a mere cipher, and told how he was to vote at elections, he will ere long dictate to his landlords how they must vote in Parliament on such occasions as the "game laws" and "tenant right." Now, if farmers' clubs can effect such revolutions as they have done, in the practice, in the social and intellectual position, and in the political influence of the farmer at home, why should they not produce the same results in this country? Here we are quietly, for the want of some such union, allowing one of the curses of England, the game laws, to be fastened upon us, and never bestowing a thought upon "tenant right." Farmers' clubs are a far greater necessity as a means of collecting and diffusing information in a new country like this, than in an old one. Here we have a climate so widely different from that of the old country, that we have as it where to begin afresh, and elaborate a practice in accordance with climatic and local requirements. Nothing can aid us more in doing this, and in devising some course of rational cultivation, than periodical meetings of farmers, to "reason together" on questions affecting their interests and the progress of their art. By such means many valuable facts, derived from practical experience, and that would otherwise be lost, will be corrected and recorded. It is from farmers' clubs that some scheme for the education of young farmers should emanate, and the neglect of their education, as I have already pointed out, may be attended with injurious consequences to the State. The formation of these clubs should be a simple matter; all that is requisite is fixed times for meeting, a sensible chairman, active secretary, and the apostle Paul's definition of charity, slightly modified as rules for the guidance of members. I hope soon to see them flourishing in every district in the colony, and I feel sure their establishment will be attended by good results to farmers themselves, and to the community at large. Another thing that, in my opinion, would promote rational cultivation is a law of "tenant right." This may perhaps sound strange in a new country where every one is supposed to sit under his own vine and fig-tree. Still it is nevertheless a fact that we have a large and an increasing class of tenant farmers amongst us. The conditions here are very similar to those which in Ireland have led to such a complication of interests between landlord and tenant, paralysed industry and energy, and retarded the progress of rational agriculture in that country. We, too, have our absentee landlords, and tenants have in most instances to make all their own improvements. The sooner we have some legal enactment that will secure to the tenant at will, in the event of having to leave his farm, just compensation for permanent improvements made by him on the farm, and for unexhausted improvements in the soil—the sooner we have some tenant-right of this sort the better, as such a bill would materially tend to promote rational cultivation by tenant farmers. Our meat-preserving companies, too, inasmuch as they will tend to maintain a higher standard of value on stock of all sorts, and the praiseworthy—I might say patriotic—efforts of Mr. Matthew M'Caw to induce farmers to manufacture cheese and cure butter and bacon in such a way as will secure for them a European market, may be justly regarded as tending materially to aid and promote a rational system of cultivation. But above and beyond all things, I would urge upon the attention of cultivators the duty of reverence and respect for the laws of nature ordained by an all-wise Creator, without which permanent success in cultivation is simply unattainable. The more we study and examine those laws, the greater will be our reverence and respect, and as we obtain clearer views of the wisdom, beauty, and harmony of creation, the stronger will our convictions become that they cannot be outraged, infringed, or disregarded with impunity. Science expounds those laws. If, in the course of my remarks, I may seem to iterate and reiterate certain things, it is because I wish them to be remembered and thought about. The subject, I need hardly say, is far from being exhausted, and I only regard the few thoughts I have thrown together in this paper as a peg upon which you will hang more valuable information; and I will conclude with the following quotation, which may be carefully studied by statesmen as well as farmers:—"Thus, my friends" says the profound Goethe, "if we survey the most populous provinces and kingdoms of the firm earth, we observe on all sides that wherever an available soil appears, it is cultivated, planted, shaped, beautified, and in the same proportion coveted, taken into possession, fortified, and defended. Hereby we bring home to our conceptions the high worth of property in

land, and are obliged to consider it as the first and best acquirement that can be allotted to man. And if, on closer inspection, we find parental and filial love, the union of countrymen and townsmen, and therefore the universal feeling of patriotism, founded immediately on this same interest in the soil, we cannot but regard that seizing and retaining of space, in the great or the small scale, as a thing more important and venerable. Yes, nature herself has so ordered it. A man born on the globe comes by habit to belong to it; the two grow together, and the fairest ties are spun from their union. Who is there, then, that would spitefully disturb this foundation-stone of all existence; that would blindly deny the worth and dignity of such precious and peculiar gifts of heaven? And yet we may assert, that if what man possesses is of great worth, what he does and accomplishes must be of still greater. In a wide view of things, we must look on property in land as one small part of the possessions that have been given us. Of these the greatest and most precious part consists especially in what is moveable, and in what is gained by moving "life." The "moveable" and "moving life" of the soil is its fertility, and statesmen as well as farmers will do well to prevent the ignorant or wanton destruction of this "foundation-stone of all existence."—*The Australasian.*

ON THE MANUFACTURE OF CUTCH FROM KHAIR.

(*Communicated.*)

ALL over the high country (with a red laterite soil) that extends from the west of Burdwan district to right across the Soane river, there is a great growth of scrub jungle composed in the more damp portions of stunted sâl; and in the more dry portions, of various descriptions of mimosa, acacia, zizyphus, &c.

Towards the Palamow district and on the high land bordering on the Soane, the poorer people take advantage of the products existing in these jungles, to help them in earning a portion of their subsistence.

After the rains are over, and the scanty crops have been gathered and garnered, (say in March, April and May), the country begins to dry up in a way that no one living in the lower portions of Bengal can imagine. It is then that the poorer people betake themselves to their friendly jungles for pecuniary help,—and the mimosas, and acacias, &c., are laid under contribution. They judge of the time for cutch manufacturing operations very nicely,—they see the leaves of the *khair* (*acacia catechu*) begin to brown, and know from it that the sap is fit for use. They then choose some old trees, and fell them (cutting as near the surface of the ground as possible). The trees so felled are cleared of branches, and the trunk and stem are cut up into logs of from 18 inches to 2 feet in length. These logs or pieces of wood, are then laid on some rocky spot to dry in the blazing sunshine. After drying thus for three or four days in the sun, the pieces of wood are taken and hacked into chips of from an inch to two inches square. The chips are then packed loosely in earthen pots or *chattees*. The *chattees* so packed have water poured into them till it overflows at the mouth—after which the pots so charged are put away carefully in some quiet place for two or more days to allow of the water to permeate the chips.

When the manufacturers are not in a hurry, they wait till the water in the *chattees* is of a red colour before they deal with the contents,—but when pressed for time, they set to work it up at once.

A fire-place of very ingenious construction is, so to say, dug out in the ground, and the *chattees* charged with the chips and water are placed on it, a fierce fire is then kindled under them and kept on burning till the boiling point has been attained. It is further continued till the *chattees* prove that about a third of the water they contained has been evaporated. The fire is then drawn and the juice so boiled out of the chips with the aid of the water, is poured off in other earthen pots or *chattees*, or into large earthen tubs. The *chattees* that contained it are cleaned out, the chips being spread out to dry for a second boiling, or fuel as appears best. The clean juice thus obtained, is now again set on the furnace to boil, and is kept boiling for about five or six hours, till it thickens into a syrup. At this stage of the manufacturing the fire is reduced to a steady blaze, and the syrup-like juice then simmering is stirred off and on till it begins to string. If the cutch is merely for local consumption, the simmering mass is kept on the fire till it is fit to set, when it is poured into holes dug in the earth and lined with leaves. It is allowed to harden in these holes till it can be handled, when it is taken out and placed in bags or otherwise. If the cutch is manufactured to pay off a *mahajun's* advances, and for exportation, the men mix a large quantity (say about a third) of ashes (obtained by burning dried "cowpats") to the stringing syrupy juice, and after taking care to mix it up well, pour out the stuff into holes in the earth, as before, where it hardens very soon, and is taken out and sent for sale.

From the result of cutch manufacture carried on by me, I have found that fifteen seers of chips produced seven-and-a-half chittacks of pure cutch, or say 30 lbs. of chips, yield 15 ounces of cutch. I did not dry the chips to free them from moisture, so the per centage may vary and can only be taken as an approximation. The manufacturers however using the ashes increase the produce by a third or more. I poured the thick stringy syrup obtained in my experiments in greased bamboo joints and obtained very fine rolls of cutch of a beautiful burnt amber color inside, and of very dark brown red on the outside. The rolls when allowed to set in a dry place could scarcely be dented in with the thumb-nail.

The natives generally use six, eight, or more earthen pots at once to expedite the boiling of the chips and of the juice after it. The fire-place necessary for working all these pots at once requires mention. It is constructed as follows :—

After a good piece of level ground has been selected in a spot where there is plenty of ventilation from the west. Two holes each about two feet square are dug into the ground to a depth of between two and three feet each; these holes are opposite each other in a west to east line, the western one being the furnace end of the fire-place, and the eastern one the flue end. These holes are from four to twelve feet distant from each other, according to the number of earthen pots or *chattees* that are to be set over the fire at once. Between these two holes other round holes, each about six to nine inches in diameter, (one for each *chattee* to fit on) are sunk. The intervening earth between all these holes is then dug out carefully, leaving about nine inches to a foot of earth from the surface downwards as a roof. The holes at the extremities are then sloped upwards from the floor of the furnace. That is, the western or furnace-end hole is sloped upwards to the west, and the eastern or flue-end hole is sloped outwards to the east. The inside of the fire-place, including the inner sides of the holes on which the *chattees* are to be placed, are all plastered smooth with fresh cowdung and clay well puddled together with water. After the plastering has dried, a gentle fire is kindled in the fire-place for two or three days off and on, this hardens all the parts, and after that it is ready for use.

The outlets on the roof of the flue once fitted with *chattees*, the fire is kindled under them and blown by the western wind, draws along the length of the flue, like the flame of a blast furnace, and by banking up the flue end to the requisite size, the heat is very fairly graduated to any degree required. Once the working of the furnace is fairly started, the earthen pots in relays are never kept idle, and very often while the chips and water are being heated at one end, the juice is thickening in the pots at the other. They save time and space too by pouring off the thickening juice from one *chattee* into another, concentrating the contents of six or eight *chattees* into two or three of them.

The prepared cutch or *khair* is cut up by the mahajuns (who have no wholesale business) into little squares weighing about an ounce in weight each. These are sold at from a half to three-quarters of a pice each. The cost of making them is about one pie each, so there is plenty of margin to work on; more so when the addition of a third of ashes to the cutch is not included in my cost of production and is included in the selling figure.

PRODUCTS OF THE ORANGE FAMILY IN THE SOUTHERN STATES.

THIS interesting genus is composed of small, evergreen, much-branched trees, growing about fifteen feet high, and having coriaceous, ovate, shining leaves, and odoriferous flowers and fruits, which combine beauty and colour with pleasant taste and odour. The leaves are pale green and when bruised, have a very fragrant odour and a warm, pungent taste. They contain volatile oil.

Of the eight species of *citrus*, yielding interesting flowers and fruit, the sweet and sour oranges, limes, shaddocks, lemons and citrons are the ones interesting to us. The flowers, which have a delightful odour, are large, white and attached by short peduncles simply, or in clusters, to the smallest branches. The petals are oblong, white, concave and beset with numerous small glands. The filaments are united at their base in three or more distinct groups and support yellow anthers. The calyx is saucer-shaped with pointed teeth. The flowers in the several varieties differ in colour and odour. The orange flowers are of a creamy white; those of the limes and lemons violet-blue, and of the citrons and shaddocks the same as the oranges. The sour or wild orange flowers possess the largest amount of volatile oil.

The writer has had some experience in orange culture, extending over a period of two years at New Orleans, and closely watched the different stages of growth from seed to the full bearing tree.

In Florida the orange, lemon, and lime grow wild and are found in abundance. In Louisiana and Mississippi they are grown from the seed. The seeds are planted in early spring or in hot-beds in January. When one year old, they are transplanted in a nursery arrangement. At the age of two and a half years, they are budded, *i.e.*, the seedlings are of the sour variety, and to produce sweet oranges, fully matured buds are taken from bearing trees and inserted. This is done to render the tree more hardy, since the sweet seedlings are subject to a root disease called, heel, while the sour seedlings are not. Hence, orange growers resort to this means to produce sweet oranges. The trees are transplanted at

the age of four years into orchards. At the age of six, flowers first appear, and at ten years the trees are called full bearers.

This beautiful evergreen is found in every civilised country where the climate is favourable, and in colder countries it is the cherished ornament of the hot-house. It flourishes in our most southern limits, largely in Florida, and to a considerable extent in Mississippi and Louisiana, south of the lakes. In Mississippi and Louisiana they are favoured by the lakes tempering the cold north winds. There seems but little difference between these States in their favourable localities. However, the tree requires delicate cultivation and studied treatment. About the year 1816 oranges were introduced as ornaments to this country by the French. In 1830 an orange tree in a box, in bloom, brought 400 francs, and about this time some attention was paid by horticulturists, and blooming trees in boxes were sold at from 50 to 100 francs in New Orleans. The beginning of the cultivation of oranges for fruit, in the south, dates back to 1848, when numbers of trees were planted, but in January, 1856, a cold wave from Texas brought the temperature down to 19° F. above zero, and a large proportion of the trees were killed. Not much attention was paid to the cultivation afterwards until 1867 and 1868, and since then orange growing has been quite successful and assumed commercial importance.

The orange family affords the pharmacist two important articles—flowers and fruit. From flowers we obtain oil of neroli and orange flower water, and from the fruit we have the volatile oil of the rind, the juice of the pulp, and last but not least, citric acid.

As the orange tree is so little known in the north, a brief account will not be out of place. Owing to unfavourable conditions in cold climates, the beauty of foliage, the very grateful odour of the flowers and the delicious fruits are very imperfect in comparison to those localities where the trees attain perfection. The fruit, as it comes from Florida, is a good representation. The oil which is made from the rind is generally less agreeable. The oil of the flowers has only a faint resemblance to the odour of the flowers and the orange-flower waters, as usually sold, have but little of the delicate odour of the fresh petals. Prof. Remington exhibited a specimen of oil of neroli which, after being exposed on cloth a short time, gave the true odour of the petals, with some aridity. This was considered, and doubtless was, a choice specimen, but other varieties are probably made from whole flowers, branches and young fruit.

The time of flowering is from the beginning of February until the 10th of April, in healthy trees; unhealthy ones are found in bloom sooner or later. The last week of February finds most of the trees blooming. The petals remain on the flowers for about two weeks. Unfavourable conditions shorten the time. The humidity of the atmosphere materially affects the flowers—when too wet the pollen heads are injured and the secretions are imperfect. Dryness has a similar effect on the pollen and nectar, but does not affect the secretion of oil. When the temperature is too low, but few flowers are fructified, the oil cells are limpid and no nectar is secreted. The most favourable temperature is about 68° to 76° F. Under 60° F. flowers are blighted. When the busy bee is found collecting the nectar, the conditions are favourable for the development of flowers and fruit, and then the flowers contain their most agreeable odour.

An ordinary tree will yield from two to ten pounds of flowers ordinarily about seven. As soon as the petals begin to fall a canvas is spread under the tree, and by brisk shaking the petals will fall, with some leaves, which are easily separated. The time when flowers are most fragrant is early in the morning, for late in the day the odour is greatly diminished. Prior to the late conflict, negroes collected and sold orange petals in New Orleans. A tea-saucer full (about 2 ozs.) was measured out, put upon a china plate and set in the room, for which the negro received about fifty cents. From two to three plates would perfume a room for a week. Orange flowers produced in the extreme southern borders are believed to possess a stronger odour and more oil. The difference is accounted for in this manner: In the tropics and semi-tropics the trees do not begin to bear very much until about twenty years old, while in this country they begin at about seven. The development is more rapid, the tree more vigorous, and it is reasonable to suppose a better development of odour in the flower. The writer was informed by an orange grower who had extensive observations in different countries, and fully confirmed this supposition. The flowers are more fragrant, and the fruit more juicy, but not so sweet as in some other countries.

The pharmacist buys the products of the orange from over the sea. That oft-used name *imported* always adds an imaginary value of more than a hundred per cent. It is said to pay the producer of California wines to send his wine to France, and, having the label changed and translated into French, bring it back here, pay freights and double duty, and then realise one hundred per cent. on the transfers, because the consumer considers it far superior to our wine. Just so with our neroli and the orange flower water and fruit juices. Almost all the crude material for citric acid is imported. This need not be. There is abundance to be had in the south. Florida furnishes flowers sufficient for America for the oil of neroli, orange-flower water, citric acid, fruit juice and oils of the rind, and if no misfortune happens to the sweet orange plantations, there will soon be fruit sufficient for the United States from the 1st of November until May.

The writer made several experiments with orange flowers. When placed in the direct sunlight, in the course of two days they lose all their odour. In diffused day-light they retain it for at least three days, and in a dark, humid atmosphere the odour is quite distinct after one week. When bruised, they lose their odour in half of the time stated. The writer had no means for experimenting as to the amount of volatile oil, but he believes that the better plan for the pharmacist is to have the petals hermetically sealed, and to make his preparations direct.

Orange flower water is one of the most agreeable vehicles for nauseous medicines that we have, and when the pharmacist can make fresh preparations they will be fully appreciated and the expense will not be greater. The syrup of either flower or fruit has no superior, especially the syrup of the fruit. A honey collected from orange flowers is very fragrant with the orange odour. The flowers, placed in tin cans and sealed up, are known to have retained their odour unimpaired for nine months. As a perfume they have no equal. To sit under a tree when in full bloom is delightful—the fragrance intoxicating. If any one has made the syrup of orange from the fresh juice of the fruit and used it, he will not want to use any more which is made from simple syrup and a few drops of the oil of the rind.—W. B. RUSH, IN *American Journal of Pharmacy.*

THE ADVANTAGES OF THIN SEEDING.

THAT the inquiry into the relative advantages of thick and thin sowing has a peculiar claim on the attention of agriculturists, especially at a critical time like the present, will be universally admitted. Any alterations in our systems of field culture, which give promise of increase of production without entailing a proportionate increase of expenditure, are certain to commend themselves to a suffering agricultural community; but when a proposal not only does this, but holds out the probability of increased production with reduced outlay, it deserves to be all the more eagerly and carefully tested. It cannot be said that there is any novelty about the suggestion in favour of thin as compared with thick seeding, for, based upon successful experiments, it has long found an able advocate in Mr. Mechi, and more than twenty years have elapsed since Mr. Bowie, Mains of Kelly, near Arbroath, gave to the world the results of experiments conducted on his farm, and which have been received as valuable testimony in favour of economizing seed. The conditions of soil, climate, and quality of seed are however, so varied, that different experiments cannot always be expected to bring out precisely similar results. Hence, perhaps, it is that many still hold out for sowing thickly on soils, where it may be that peculiar constituent elements have tended to favour that particular method of cultivation, without, however, establishing any general rule. Twenty years ago it was quite a common practice in Scotland to sow 8 bushels of oats, 5 of barley, and 5 of wheat per Scotch acre, but in recent years these allowances have been considerably modified with profit to the cultivator.

We mentioned instances of successful crops grown in this way—one, a fine crop of potato oats, from 2 bushels drilled per imperial acre; another, with a rather smaller allowance applied in a similar manner; and a third, a crop of barley, from only a bushel per imperial acre drilled into the soil. The last mentioned will no doubt be deemed somewhat exceptional; and considering the fickleness of seasons and of British climate it might not be safe to lay it down as a practice to be invariably pursued. But after these and many more equally noteworthy results had been brought to light, Mr. Milne, Mains of Laithers, Aberdeenshire, has just startled Mr. Mechi, Mr. Bowie, and other enthusiastic advocates of thin sowing, by recalling in our columns the fact that he had ascertained, by experiments on his farm several years ago, that 8 bushels of oats, drilled at 4 inches apart, yielded the largest return. The idea of any farmer even experimenting with 12 bushels of oats per acre, is enough to 'flabbergast' those who, by careful experiments on their respective holdings, had long ago satisfied themselves of the advantages of thin sowing. As Mr. Mechi happily expressed the other week, the precise allowance of seed must be determined to a considerable extent by the climate and the condition of the soil; but taking the country all over, we have no doubt there has hitherto been, and still is too much seed applied. We claim to have had some experience of farming on even higher altitudes than that of the Turriff district of Aberdeenshire; but we can hardly conceive the circumstances under which more than 6 bushels of oats per acre sown with the hand can be justified. Anything like that allowance is necessary only in the highest altitudes, and on the poorest soil. We heartily agree with Mr. Milne, however, when he points, out that it is discreditable to the agriculture of this country, that there should still be so much difference of opinion—even where climatic and other conditions are not dissimilar—regarding the proper quantities of seed to sow. It appears to us that our national agricultural societies might, by a series of experiments with thick and thin sowing, conducted in different districts of the country, solve this question, and so confer substantial benefits on the agricultural interest.

Reverting to some of the experiments which have already been placed on record, we find considerable diversity of opinion and of results; but such as they are, we need make no apology for re-introducing their substance to our readers.

Mr. Mechi's experiments have been so often referred to, that in speaking of the enlightened practice adopted at Tiptree, we need do no more than repeat what has often been recorded in these columns, that Mr. Mechi obtains from 1 bushel of wheat per imperial acre (drilled) an advantage of

30s. per acre as compared with 2 bushels, which is the quantity of seed commonly applied to the acre in Essex. Of barley, he has grown as much from 1 bushel as from 6 to the acre, drilled at 6 inches apart. Of Tartarian oats, he finds that even 2 bushels per acre is too liberal an allowance; and by drilling 8 pecks per imperial acre, he frequently raises 83 bushels per acre—in one instance as much as 104 bushels. He admits that thick sowing may be useful in late districts, because it hastens the harvest; but the idea of sowing 12 bushels of oats to the acre entirely upsets his experience and observation.

We may next refer to the system pursued nearer home, on the well-known farm of Mains of Kelly, the luxuriant grain crops of which it would be difficult to surpass anywhere, for quality of ear, or strength and bulk of straw. About a quarter of a century ago, Mr. Bowie, in common with his brother agriculturists, was in the habit of applying 8 bushels of oats, 5 of barley, and 5 of wheat per Scotch acre; but as the result of long and careful observation, he was induced to undertake experiments with a view to ascertain the benefits of thin sowing of oats in pressed drills, the seed being by the use of the presser all covered in, and at equal depths, with a uniform firmness of seed-bed. The soil, a brown loam, was rather in poor than in rich condition. Four lots of three rings each were carefully measured, and the seed carefully weighed. Lot one received 6 bushels, lot two 5 bushels, lot three 4 bushels, and lot four 3 bushels per Scotch acre. Each lot received 2 cwts. of dissolved bones sown into the pressed drills with the seed, though there was no perceptible influence from this as compared with the rest of the field, which received no special manure. Lot one yielded 53½ bushels per Scotch acre; weight, 42¾ lbs., with 35 cwts. 1 qr. 8 lbs. straw. Lot two gave 58¼ bushels; weight, 43 lbs., and 38 cwts. 1 qr. 21 lbs. straw. Lot three yielded 66¼ bushels; weight, 43¼ lbs., and 45 cwts. 1 qr. 12 lbs. straw. Lot four gave 66¾ bushels; weight, 42¾ lbs. with 47 cwts. 2 qrs. 10 lbs. straw. The increase of straw per Scotch acre in No. 4 over No. 1, amounted to 98 imperial stones, which at 4d. gave £1 12s. 8d.; the increase of corn, 1⅝ qrs. at 30s., £2 9s. 8d., and the saving in seed, 0⅜ qrs. at 30s., gave 11s, 3d.—or a total advantage in money of £4 13s. 7d. per Scotch acre. Mr. Bowie also found that the two thinnest sown lots were first ready to stack, as from the greater strength of the straw they were more easily dried in the stook. From the close approximation in yield of lots 3 and 4 (or the thinnest sown) he was further led to infer that 3 bushels per Scotch acre sown by drill, or after pressers was about the lowest safe point in the thin sowing of oats. These results are reported in the October number of the Highland Society's *Transactions* for 1855.

In the year 1856, Mr. Bowie made further experiments with the view of testing the foregoing. The 1854 experiments were with a maximum sowing of 6 bushels and a minimum of 3 bushels per Scotch acre. In the later tests the maximum was reduced to 5, and the minimum to 2½ bushels, so as, to use Mr. Bowie's own words, to get at 'the back end of thin sowing.' It has further to be observed, that whereas in 1854 the season was dry and singularly fine for the maturing of cereals, that of 1856 was quite the reverse, being wet, cold, and unsuitable for tillering. Another difference has to be noted. The 1854 experiments were on brown loam mostly incumbent on gravel, and in comparatively low condition. The later experiments were on both Mains of Kelly and West Scryne. The soil of the former was similar to that on which the previous experiments had been conducted, though in good condition and more suitable to the presser; but on West Scryne it was described as 'brown, heavy, and somewhat stiff, and although not clay, incumbent on clay and a little sandy gravel—not so suitable for the use of the presser but in the very highest condition. Though the 1856 experiments were on land in comparatively higher condition, yet the profits from thin sowing were greatest where the land was in low condition—a circumstance partly attributable to the higher price of oats at the earlier period. The results from the five lots on West Scryne are reported in the March number of the Highland Society's *Transactions* for 1857. The pressed lot sown with the minimum quantity of seed, viz. 2½ bushels, succeeded admirably, and as compared with the pressed lot sown with 5 bushels, the difference in favour of the smaller quantity amounted to £2. 14s. 2d. per acre, or an increase of 6 bushels corn, 95 imperial stones of straw, and 2½ bushels seed to the acre. The loss by the use of guano on rich land in a wet season were estimated at at £2. 17s. 0d. per acre, and the total saved by the use of the presser, and sowing 3 bushels, was found to be £1 14s. 1d. per acre. On Mains of Kelly, the increase of corn from 2½ bushels, as compared with 4 bushels per Scotch acre, gave 6¾ bushels at 28s. per qr., 13s. 7d.; increase of straw, 33 imperial stones at 4s., 10d.; saving in seed, 1½ bushels at 28s. per qr., 8s. 9d.—total saving per acre, £2. 2s. 4d. The increase by sowing 3 bushels as against 5 bushels was shown to be per acre, 6½ bushels corn, 31 imperial stones hay, and 2 bushels of seed; leaving a total saving from 3 as against 5 bushels amounting to £2. 0s. 2d. per acre, being a triumphant confirmation of the advantages of thin sowing. Mr. Bowie has ever since used only about 2 bushels per imperial acre, and has grown very superior crops.

On December 2, 1868, we reported the results of an experiment by Mr. J. B. Duff, Lydlate, Ormskirk, in favour of thin sowing. This experiment with wheat was conducted on two statute acres, the crop of the previous year having been potatoes. At the rate of a peck per acre, the seed was sown with a machine adapted for dibbling, the drills being 7 inches apart. The grain thrashed by machinery gave the following return:—97 bushels of 66lbs. to the bushel; or per acre, 48½ bushels of 66 lbs., being 45 market bushels of 70 lbs., besides 4 bushels of light wheat, suitable for pig feeding. The crop was one of the first to ripen in the district; and so satisfied was Mr. Duff with the result of his experiment in favour of thin-seeding, that in the following season he sowed a field, which was not in very good condition, with half a bushel per acre, and another, in good condition, with less than one quarter bushel per acre.

Mr. Milne, Mains of Laithers, Aberdeenshire, states that he conducted experiments in 1868 and two following years, with the result (in 1868 and 1869) that 8 bushels of oats, drilled at 4 inches apart, yielded the largest returns, both of grain and straw, while plots drilled at 4 inches produced about a quarter per acre more than the wider drills. The quantities of seed put into the ground by Mr. Milne in the course of his experiments varied from two to twelve bushels per acre. We have not been able to find any detailed record of the Mains of Laithers experiments in the years 1868 and 1869, but in a communication addressed to us in the following year, Mr. Milne observed that in 1869 the results 'were decidedly in favour of thick-sowing. The 7 and 8 bushel lots produced the heaviest crops of grain and straw.' In 1870, Mr. Milne's experiments in the sowing of oats do not appear to have borne out altogether the theory which he has advanced in favour of thick sowing. Indeed he himself admits as much, for in reference thereto we find him writing in 1870—'This year (1870) the results are not too decided—the thickly-sown lots on the whole producing the greatest yield; but when the extra quantity of seed used is deducted, the advantage is in favour of the 4 bushel lots.' For the benefit of readers interested in this subject, we may reproduce the table relative to Mr. Milne's experiments of 1870, published by us in that year. It should be explained that the grain weighed 43lbs. per bushel, but in the following table it is calculated into quarters and bushels of 40 lbs.

AVERAGE OF TWO EXPERIMENTS.

Field No. 1.

Seed per acre.	Total grain.			Grain after deducting seed.			Straw and chaff.	Percentage of grain.
Bush.	Qr.	bush.	lbs.	Qr.	bush.	lbs.	lbs.	
4½	5	7	20	5	3	0	2900	39·58
2	5	6	31	5	4	31	3042	38·09
4	6	1	4	5	5	4	3237	37·41
6	6	1	32	5	3	32	2935	40·42
8	5	7	13	4	7	13	2709	39·84
10	6	1	10	4	7	10	2709	42·10
4½	6	1	1	5	4	21	2850	40·75

Field No. 2.

Seed per acre.	Total grain.			Grain after deducting seed.			Straw and chaff.	Percentage of grain.
4	6	4	37	6	0	37	3709	36·34
8	6	5	33	5	5	33	3993	35·08
12	7	1	30	5	5	30	4497	34·08

Referring further to the above, Mr. Milne wrote on Dec. 14, 1870:—The difference in the percentage of grain to straw in the last three years, as shown by these experiments, is remarkable. In 1868 the experimental lots yielded 48·8 per cent. of grain to 51·2 of straw and chaff. In 1869 they yielded 44·95 per cent. of grain. In 1870 No. 1 field yielded 39·75, and No. 2 only 35·15 per cent. of grain. The Longfellow variety of oat, sown in No. 2 field may account for the low percentage of grain, but in No. 1 field, the variety of oats was the same, and the quality and condition of the soil were very similar to that of the 1868 and 1869 experiments.—*N. B. Agriculturist.*

LEAVES AND THEIR FUNCTIONS.

A LEAF, whatever may be its configuration or colour, is always an object of interest. But how few people when they see a leaf as it waves and flutters in the breeze really know what they are looking at. Leaves appear in an endless variety of forms, sizes and colours. They are often so transformed that it is more by the place they occupy than by their forms that we know they are leaves. Underground stems or rhizomes have them at each point or node as little thin scales. Buds are enveloped in peculiar cerements, which generally fall away soon after the ordinary leaves have begun to expand; those enveloping scales are only leaves in a modified form. They are quite prominent in the hickory and horse-chestnut. The scales of bulbs, as of the lily, are simply modified leaves. Flowers are only aggregations of metamorphosed leaves. But it is with leaves as foliage that we are more immediately concerned at present. A complete leaf consists of three parts; the stalk or stem (petiole) on which it rises, the expanded blade or lamina, and two small leaf-like appendages at the base of the leaf-stalk called stipules. The only essential part is the blade, as this may be sessile on the stem without either petiole or stipules. The blade of a leaf consists of three portions; the woody frame-work, ribs or veins, the green cellular portion, pulp, and the outside covering or epidermis. The epidermis, which is really an extension of the outer bark of the stem, is composed of closely-united, transparent cells, with frequent openings through it called stomata or breathing pores. These vary in number from 800 to 170,000 to the square inch of surface. It is through these that water is exhaled from the plant. They are more numerous

in the leaves of plants growing in moist situations and surrounded by a damp atmosphere. The pores dilate with the increase of humidity and contract with the increase of aridity. Plants growing in arid climates have but few stomata, and these are very small. While the most of foliage appears to be made on the principle of exposing the greatest possible surface to the air; some forms of vegetation seem to be constructed for the accomplishment of the very reverse of this. Thus the various species of cactus, whose native habitat is the hot, arid plains of the south-west, are constructed on the principle of presenting the least extent of surface to the air, and this surface is covered with an epidermis that is almost impervious to water. This is necessary to prevent excessive transpiration in that very dry climate. The pulp or parenchyma of the leaf is made up of several layers of cells. These cells are small globular sacks, varying from $\frac{1}{1200}$ to $\frac{1}{250}$ of an inch in diameter. A layer of these of a rather elongated form is arranged immediately beneath the epidermis of the upper side of the leaf with the ends to the surface. These are crowded quite closely together. Another layer not quite so much elongated and less compactly arranged, is found on the under side of the leaf. Between these two layers are numerous globular cells that seem thrown together without any great regularity or order. Among these are numerous irregular passages, intercellular spaces, through which water and air circulate. These reach the surface through the stomata of the epidermis. It is worthy of notice that by far the larger part of these breathing pores are on the under surface, and this surface always seems to avoid direct sunshine. If a leaf is inverted, turning the bottom side upward, it will, if possible, return to its natural position, and if prevented from so doing, it will soon die. A few leaves have been known to grow in a vertical, instead of a horizontal position. The frame-work of leaves consists of wood, and is intended to give firmness and support to the leaf. It is divided into numerous veins or nerves that ramify every part of the green parenchyma. There are two distinct systems of venation of leaves: the parallel veined and the net veined. In the former the fibres run nearly parallel from one extremity of the leaf to the other; such leaves are usually long and narrow, linear, as in the grasses, corn, &c. In the other the veins are netted, ramifying the leaf in all directions and dividing the parenchyma into numerous small squares and diamonds. This style of venation exists under two forms; in one a principal vein, midrib, extends from the base to the apex of the leaf, and from this numerous smaller veins branch off and run to the margin; in the other there are three or five nearly equal ribs running the length of the leaf. The first is feather veined from its resemblance to a feather, and the other is palmately veined, the main ribs branching out like the fingers of a hand. The shape of a leaf is generally determined by the manner of its venation. The two principal styles of venation belong to and denote two different classes of plants, the parallel-veined belonging to the monocotyledonous, and the net-veined to the dicotyledonous divisions of the vegetable kingdom. Thus the veining of a small portion of a leaf will indicate to which of these classes the plant upon which it grew belonged.

The green colour of leaves comes from a granular substance, chlorophyll, found in the cells of the parenchyma. In its absence no true vegetable structure can be built up from the original elements, and it can operate only in the presence of sunlight. Low cryptogamic plants will grow in the dark, but they contain no proper chlorophyll. Chlorophyll has been found to be composed of two different substances, xanthophyll, a yellow substance, and cyanophyll, a blue material; their union forms chlorophyll, or leaf-green. It is thought that the yellow colour of leaves at maturity is caused by the predominance of xanthophyll at that time. Besides chlorophyll, the leaf cells contain the proximate principles of the plant, and here the real work of building plant structure is performed. But this brings us to the consideration of the second part of our subject, *viz.*: the functions of leaves.

In treating this branch of the subject, it will be necessary to consider the leaf under several different characters. Leaves should be considered as real living beings, capable of performing vital functions, as workers performing a large amount of important work. We may first consider the leaf as a pump. One of its most important offices is to pump up water from the soil through the roots and stems of plants. This it exhales through its stomata in the form of invisible vapour. By this means a large quantity of water is carried up from the soil to the atmosphere. Thus a large portion of water that would quickly settle down through the deeper soil and find its way into underground passages, is carried up and given off to the atmosphere, where it is condensed into clouds and descends in rain, thus watering and making fruitful the earth. Without this work many parts of the earth that now blossom as the rose would become arid wastes. The amount of moisture thus carried up and exhaled by the foliage of trees and plants is immense. A sun-flower, with a leaf surface of 39 square feet, exhaled three pounds of water in twenty-four hours. A maize plant, in about three-and-a-half months, gave off in vapour thirty-six times its own weight of water. A medium-sized forest tree will pump up and exhale about five barrels of water in twenty-four hours. This will give about 800 barrels to the acre. An acre of grain or grass will do about the same. From this it may be seen why forests exert such a powerful influence on the rainfall of a country.

Again, we may consider the leaf as a lightning conductor. It is one of the most efficient conductors of electricity ever made. Most leaves have notched edges; each of these "points" is powerful to attract the electric fluid from the air and through the stem convey it silently to the ground. A single blade of grass is said to be three times as powerful to attract electricity as a fine cambric needle, and a twig covered with leaves is more efficient than the best constructed "patent point." A tree covered with leaves is the most efficient safeguard from lightning that can be found.

A green tree is constantly conveying electricity from the earth to the air and from the air to the earth. True, it sometimes tries to carry too large a load in response to the efficient collecting power of the leaves. They gather it in faster than the trunk can carry it away and it is bursted. We say the tree is struck by lightning. It has often been struck before, but this time it was over-loaded and crushed. Trees are natural lightning-rods, more efficient than all the artificial ones that have ever been invented.

In the next place we may contemplate the leaf as an organiser of organic matter. *It is here that it has performed its most efficient* and most important service for man. Through its agency every particle of both vegetable and animal organism has been either directly or indirectly built up. Every plant, tree and shrub has been directly built up through the labour of the leaf, and every animal, whether fish, reptile, bird or mammal, whether domesticated or wild, useful or injurious, has found its support in the material organised through the labour of the leaf. And even long before the present order of things existed, the leaf was at work. Through its labours vast beds of vegetable matter were laid away far back in the carboniferous ages, which by heat and pressure have become coal, forming vast storehouses of excellent fuel. And still further back, in times when silurian seas washed the shores of limited bodies of land, the leaf was at earnest, ceaseless toil. Thus we owe to the leaf not only what makes life pleasant, but our food and raiment and fuel, without which life would be impossible. Without the leaf as an organizer the earth would sink back into a lifeless, pulseless waste.

Lastly, we may consider the leaf as a chemical agent, withdrawing and consolidating various poisonous gases, which if left in the air would render it unfit to sustain life, and thus convert the earth into one vast charnel-house of the dead. The air contains $\frac{1}{2500}$ of its own bulk of carbonic acid, consisting of two equivalents of oxygen and one of carbon. This gas is a deadly foe to animal life, and if permitted to accumulate in the air would soon render it unfit to sustain life. And yet there are certain processes constantly going on that tend to augment the proportion of this gas in the atmosphere. Every breath of every human being and every living animal, and every bit of fuel that is consumed, and every particle of vegetable matter that decays, and every volcano that sends forth its deadly fumes, are adding to the quantity of this gas in the atmosphere. *By what agency, then, is the equilibrium maintained? It is through the agency of our little friend the leaf* that the work so essential to life and health is performed. It is constantly employed as an analytic chemist imbibing this poisonous gas and analyzing it, using the carbon to build up the organic substance of its own structure, and giving up the healthful, life-giving oxygen to the atmosphere again. This process is so regulated as exactly to keep pace with the liberation of carbonic acid through the agencies mentioned above. Other deleterious gases are thus taken in and rendered innocuous. The blue gum (*Eucalyptus globulus*), of Australia, has become famous for absorbing the deadly gases in miasmatic districts, and thus rendering them healthy. Thus the leaf labours preparing food for all living animals, and raiment and fuel for the lords of creation, as well as all wood and bone and ivory used in the arts. It also purifies the air, making animal life possible, and clothing the earth with beauty, that the life thus preserved may be replete with the highest enjoyment.—REV. L. J. TEMPLIN, HUTCHINSON, KANSAS.—*The Journal of Applied Science.*

ENGLAND'S UNDEVELOPED AGRICULTURAL RESOURCES.

WITH the general stagnation of trade, and its concomitant effects on our agricultural markets, we shall no doubt be doing good service by pointing to our *undeveloped* agricultural resources. In fact, this subject appears at the present time to be one of national importance, if our national prosperity is to continue in the future as it has flourished in the past; for it is far from being positively uncertain that we have reached the zenith of our industrial prosperity. We trust our industries may revive, yet though foreign competition, over-production, depreciation of silver, short hours of labour, strikes, intemperance, adulterations, heavy taxation, foreign policy, high tariffs and even sun-spots, may be assignable causes of trade stagnation, all of which have been similarly experienced in other times of depression, it is not asserting too much in avering that our *present* industrial stagnation has been much longer continued, and has arisen from entirely new causes. We must not shut our eyes to the fact that we have not only built up a glorious fabric of manufacturing power for ourselves, but that we have also contributed very largely to the same results all over the world. The world has been supplied by us with men, mind, material, and money, and we have reaped

our reward by becoming rich and powerful. Having taught other nations, and been paid for the tuition so given, we are surrounded with imitators in every civilised country, and now half the world can do without us, while the business of the other half is being competed for by our rivals. This is an entirely new phenomenon presented to our trade-outlets, and with this prospect before us, we can only ask ourselves. If the old markets will not take our goods, what are we to do? The answer is obvious, for we must either find new customers, or we must turn our capital into new channels of industry!

The first of these alternatives is one with which we need not here engage ourselves; but the very fact that we have undeveloped food supplies and undeveloped agricultural resources in our own country may give us courage, and prevent us from drifting in a sea of indifference, by simply trusting to Providence, whilst—should things come even to the worst—our agricultural resources may help our old country from being consigned to ruin! Let us, then, inquire what these resources are? On the authority of the late Richard Cobden, "we have land enough to keep one hundred millions of people, and if an equivalent abundance of capital was employed on our farms, with the same skill as our manufacturers conduct their business, there would not be hands enough to cultivate the land." Lord Ducie expressed the same opinion by saying "that if all the land was under cultivation there would not be hands enough to till it." We have 80,000,000 acres of land in the United Kingdom and the Channel Islands, and of this acreage little above half—namely, 50,000,000 acres—are under cultivation. The fact that at the present time, this cultivated land is yielding little, and in some cases nothing, more than it did at the commencement of the century, in spite of agricultural chemistry having made prodigious advance in the same time, showing how two blades of grass could be grown where only one grew before, we note the undeveloped resources of these 50,000,000 acres, to which we must add the 30,000,000 acres not farmed at all, or at any rate hardly touched by spade, plough, or harrow. This state of things certainly seems to corroborate the conclusion which has been drawn, namely, that we are a manufacturing nation and not agriculturists. The relative proportion of persons engaged in the manufacturing and agricultural trades certainly confirms this view, for out of a population of say 34,000,000, there are 1,399,000 agricultural labourers, earning in average times £61,000,000, whilst in the manufacturing industries there are 6,526,000, earning upwards of £327,000,000. If we revert to France, we find by way of contrast that 18,968,000, or 53 per cent., are engaged in agriculture, whilst only 9,274,000, or 27 per cent., are employed in manufacturing and other industries. For a considerable number of years our manufacturing industries have drawn heavy supplies from the agricultural districts, and it is also probable that in 990 cases out of every 1,000, capital has rushed into manufacturing of every kind, whilst the odd unit will scarcely be found in an agricultural enterprise. We believe that this state of things has also largely to do with our present depression of trade, for, now that there is a failing demand for our manufactures, the surplus labour is at a loss how and where to settle itself, and what we require is a more natural balance between our manufacturing and agricultural industries. If manufacturing is no longer our monopoly, let us make use of our agricultural resources and develop them to the best possible advantage, and we may be sure it will add greatly to our wealth, besides creating a greater exchange of commodities at home.

Let us now turn to our home food supply as another undeveloped resource of the country. Our meat supply at the present time is calculated to average 2½ oz. per day per head, whilst it is indisputable that we have the means at our command of producing six times as much; in other words, we are now producing only £40,000,000 instead of £240,000,000 worth of meat. According to another eminent authority, we might raise our annual home supply of beef, mutton, pork, corn, and wheat by £400,000,000, or in round numbers by about £12 per head; yet this is being neglected. Instead of doing this we are annually importing £115,000,000 of food supplies from abroad, which outward supply we might thoroughly extinguish even if it was three-and-half times as large as it is. Instead of benefiting by the immense quantity of food we require, we leave others to make capital out of it. Under such circumstances is it surprising that according to latest advices, the Canadian province Ontario *alone* intends to ship to England in the coming spring some 250,000 head of cattle, and 500,000 sheep, which quantity is a much larger number of cattle than we received from all outside sources during the whole of the year 1877?

In conclusion, whatever may be the upshot of the paralyzed state of our commerce in every manufacturing town in England, and however strongly we may argue that because we have rallied from former crises, we shall recover from this present depression, sure it is that, should our foreign trade expand to an unprecedented magnitude never anticipated, we shall largely benefit by employing our undeveloped agricultural resources in the manner we have alluded to, whilst, should it come to the worst, an the world refuse to take our manufactured goods, a proper and judicious development of our undeveloped agricultural resources will remain our only means of being able to continue to pay for our ever-increasing imports.

SCIENCE AND PRACTICE.

—*Country Gentleman's Magazine.*

ESPARTO GRASS TRADE OF TUNIS.

THE following detailed account of the manner in which the esparto grass is collected and shipped may not be without interest, especially since many inquiries have been addressed to Vice-Consul Dupuis on the subject. Although more goes to Great Britain from Susa, yet the quantities collected on the more southern coast and shipped at Sfax and Gerba are very considerable, and may eventually exceed those at Susa, on account of shortness of distances and conveyance by water, rather than by camels, which is always costly. It is brought during a few months of the year, loose in bundles, from a number of places to Sfax and Gerba in boats, averaging from two to twenty tons. A good deal comes from Shebbah, some 35 miles to the north, and not an inconsiderable quantity by land transport from Agareb, 20 miles inland. From the hills of Hammah also and Zinas large supplies have lately been sent. Much comes from Shirah, 50 miles south, during four months of the year. At two or three days journey inland from Susa the grass grows over a large tract of country, as is the case at Gabes, a name pretty well known, and some 80 miles further south round the coast. Here, likewise, the Akariat flows into the sea, being one of the few rivers in the country which sends water to the sea all the year round. It irrigates a strip of land about half a mile in width on its left bank, extending many miles up its course, and a luxuriant vegetation appears in strong contrast with the bare plains around. The staple product is the date of the different qualities consumed in the country. The last mile of the channel of the river forms a tidal harbour, which admits of the passage of boats up to seven tons burden only. Yet considerable trouble is experienced by them in bringing down the grass when the sea is at all rough, on account of the bar formed by the accumulation of sand at the entrance. It sometimes also happens that navigation is altogether suspended from the choking up of the passage for the waters, and the sand has to be cleared away at considerable cost and labour. It is to be noted too that loaded boats can only pass freely up the river during the ten days at spring tides, and empty ones during five days at neap tides. The right bank of the river close to the sea is high and steep, and the bundles of grass have to be pitched over into the barges beneath. Sometimes, without any other contrivance than what can be supplied by the rigging and a few planks, bales are put on board.

Shipments are made from the port of Susa direct to England, but owing to the bad holding ground and the shallows, vessels loading lie twelve miles to the north-ward, where they find good anchorage some two miles from the shore. The bales of grass are first weighed near the river, and then put on board the lighters as described, during the ten days of spring tides. If, owing to the neap tides, the lighters cannot approach, bales are carried down half a mile over the sands, below the bar, where they are easily shipped if the water is at all smooth, and the wind from the land. Zarat, 25 miles further south, is another station from which supplies are drawn. Its small harbour is formed by the narrow estuary of a stream, which runs only after heavy rains. Green or Bugreen, about 80 miles from Sfax, is another place which furnishes large supplies. It is brought from a distance of half a day's journey at the nearest, to three or four at the farthest. It is to be understood that the supplies near the coast become soon exhausted, and only if prices offer well, can they be sought for at a distance.

These are the principal stations where the grass is collected. At Shirah and Green there are no villages near the shipping places, and the agents have to camp out. At Zarat there is a small one, but some distance off, where there is a tepid spring which irrigates groves of palm and other trees. At the former two places, only brackish water is to be had. Though at Gabes it is plentiful, yet it is all hard and brackish. Besides the mentioned places, there are those of minor importance, such as Bugarah, in the bay, indenting the land opposite to the island of Gerba, and Zerzis, a port 30 miles from the Tripoli frontier, where good anchorage is to be found even for large vessels if it were opened to foreign trade. The following is the way in which the grass is collected:—Much is brought by the Arabs themselves to the markets. Money or goods are often paid or consigned in advance for grass, which is to be delivered at some indicated shore-station. Advances also are made for that which is yet to be pulled and got ready for transfer, when animals have to be hired to bring it to the coast. Buyers are sometimes sent out to an Arab encampment, which serves as a centre, and take with them money or goods (the latter generally), oil and cloth (last year, barley), which they barter for the grass, and then bring to the coast.—*Society of Arts Journal.*

SWEETS BY THE SHIP-LOAD.

THE ship *Helvetia* reached Liverpool, with one hundred tons of American honey, being the second shipment of honey made by Thurber Brothers this season; the first one, eighty tons, reached Liverpool on the 5th of November last. Twenty-five years ago Mr. Thurber made a stir in the bee-world by selling at one time two thousand pounds of honey, the product of his apiary near Cherry Valley, New York. So much honey had never before been raised by any single producer in the United States, and the sale led hundreds of staid farmers to embark in what looked like a most profitable field of industry. The result was not flattering. Poor seasons and limited bee pasturage forbade profitable bee culture, old-fashioned hives, such as eight-tenths of our hives now are in England, were then the only kind known. The modern means of robbing bees without killing them had not then been thought of. Having invented a hive that enabled the culturists to obtain successive crops of honey from the same colonies of bees and educate them to store the same in neat little glass-sided boxes, Mr. Thurber began to look around for a region that would supply the food for the bees. He searched for this in the equable climate of the peninsular state of Florida. Sheep raising was the only industry of the natives found by Mr. Thurber, when he first reached that section, in which he afterwards located. The country inland was thought good enough for sheep pasturing, but no one dreamed that the soil could be made to produce grain in paying quantities. Timber was confined to the bottoms of running streams, the valleys and hill sides being covered with a growth of stunted brush wood, from which sprang a luxuriant growth of white sage, sumac, and other flavouring shrubs which bloom there nine months of the year. Mr. Thurber

established his apiary about 100 miles from Jacksonville, with 75 hives. The brothers are now interested in more than 12,000 colonies of bees, they employ more than 300 persons, and their warehouse is one of the largest in the city of New York, and all these rich profits have been reaped from many thousands of acres that must otherwise have been a barren waste. They soon had many imitators, and there are now thousands of persons engaged in keeping bees.—*Mark-lane Express.*

THE SUGAR TRADE OF OUR COLONIES.

IN the newly issued statistical abstract for the several colonial and other possessions of the United Kingdom, a table is given showing the quantity of raw sugar exported from our principal possessions in each of the 15 years from 1863 to 1877. As a good deal has been said of late as to the effects of the continental bounties upon the sugar industries of our colonies, the figures are of interest. They do not show the trade of our colonies to be in the declining state that has been represented.

POSSESSIONS.	1863.	1867.	1872.	1877.
	Cwts.	Cwts.	Cwts.	Cwts.
India* (1863 to 1866 ended 30th April, from 1866, 31st March)	278,765	221,006	419,282	1,144,467
Mauritius	2,647,486	1,937,209	2,445,764	2 725,848
Queensland	830	...	23,959	118,885
Natal	25,947	71,071	141,932	182,163
Honduras	4,085	10,880	44,005	38,657
West India Islands :—				
Bahamas	7,269	8,000	*4,398	46,832
Jamaica	560,481	515,902	604,418	519,677
Windward Islands :—				
St. Lucia	77,903	85,950	120,632	95,138
St. Vincent	181,713	168,410	170,605	129,390
Barbadoes	718,437	918,733	668,253	808,420
Grenada	102,835	80,112	84,842	55,850
Tobago...	52,023	71,493	76,691	65,489
Leeward Islands :—				
Virgin Islands	482	6	...	15
St. Christopher	182,005	145,509	110,512	107,353
Nevis	59,275	31,892	33,656	Not stated.
Antigua	280,784	115,992	112,906	144,069
Montserrat	...	...	26,996	24,380
Dominica	53,878	56,337	61,419	67,751
Trinidad	668,225	828,807	920,466	917,080
British Guiana	1,310,785	1,412,649	1,522,928	1,915,891
Total	7,107,107	6,675 958	7,593,227	9,092,285

—*Economist.*

AFRICA: A PARAMOUNT NECESSITY FOR THE FUTURE PROSPERITY OF THE LEADING INDUSTRIES OF ENGLAND.

[BY JAS. COLLINS, F.B.S. EDINBURGH.]

Late Government Economic Botanist, Strait Settlements.

I LISTENED to Mr. Bradshaw's paper on the opening up of Eastern Africa with great interest, and would liked to have said a few words had time permitted.

The sad state in which trade now is, and the quantity of goods at present in stock, which cannot be "placed," lead manufacturers, like Alexander, to look for new worlds to conquer. Africa is pointed to as one of these new worlds, and in my opinion most justly so. I may be permitted at the outset to quote from a paper I had the honour of reading before the Society of Arts in 1872, in which the following words occur:—" Many new lands are looked upon in the same light in which the whole of Africa was formerly, as

" 'Barren sand,
Where nought can grow, because it raineth not;
And where no rain can fall to bless the land,
Because nought grows there.'

But a mere glance at the 'Flora of Tropical Africa,' now publishing, reveals such floral riches as to require no prophetic foresight to predict a great commercial future." I have never had cause to alter my opinion with regard to Africa, and at the time of writing the above paper, I was, I may say, in daily communication with the late Dr. Welwitsch, who explored the Portuguese possessions on the West Coast. In looking over with him the plants he had collected, I could not help being struck with the vast vegetable wealth available to commercial enterprise. Unfortunately, travellers and others, from various other matters taking up their attention, or from want of appreciation of the importance of the subject, rarely bring home any information as to what commercial products there are which would be likely to meet with a market here. After all is said and done, commerce is the great civiliser, and if going hand in hand with well directed missionary effort, produces the greatest possible good.

* Sugar and sugar stuffs of all kinds.

As trade amongst such tribes as are to be found in Africa, must necessarily be conducted on the barter principle, it becomes of the highest importance that information be obtained as to what we can get in return, as it is of no use sending thousands of bales or cases of Manchester or other goods, if one does not clearly see what the exchange will be. For this purpose inquiries should be instituted as to what products exist, and data collected on the spot as to the qualities obtainable, available carriage and labour, freight charges, &c., and the price the substance can be laid down at in the London market.

In conducting these researches great care is needed, as a product may be very good, but not obtainable in sufficient quantities, the price may be too high, there may be no present demand, or it may not be able to supplant a well recognised and used product, although in some cases such new products, all other things being equal, may be able to supplement the supply. To test these various questions, about a hundredweight of any such substance should be sent together with all necessary information.

It would be well if instructions, either general—or special, to suit particular countries—were distributed amongst consuls and residents abroad, and the resulting answers tabulated and arranged, so that some reliable information may be available on occasions such as the present one. If the Society of Arts could institute such inquiries much good would doubtless accrue. I append herewith a short series of instructions and desiderata, which may prove useful. To those who may wish for further information on the subject of this letter, I beg to refer to the paper already mentioned (*Journal of the Society of Arts*, vol. xx. p. 237, February 16th, 1872), and also to a paper on "The Connection between Economic Botany and Geographical Research," in the *Geographical Review* (June, 1873). I append a specimen set of questions.

SPECIMENS AND INFORMATION DESIRED ON COMMERCIAL PRODUCTS, &C.

I.—*Vegetable Products.*

A.—Specimens and information on vegetable products used as—

(*a*) Food, such as grains, esculent vegetables, starches, edible fruits, saccharine substances, &c.

(*b*) Medicinal substances used for their real or fancied effects, charms, ordeals, and customs connected therewith.

(*c*) Textile and paper materials, how prepared, with articles manufactured therefrom; whether bulky or not, and if means exist for preliminary preparation.

(*d*) Dyeing and tanning materials, how prepared and used, with articles so treated.

(*e*) Waxes, fats, fixed and essential oils.

(*f*) Gums, gum-resins, oleo-resins, balsams, &c.; caoutchouc, gutta percha; in the case of these the following—

1. Sample of crude juice, without any preparation whatever, care being taken to place the same, immediately on collection, in air-tight vessels, in order to guard against any spontaneous change taking place. If two such specimens can be sent, to one should be added a small quantity of liquor ammonia. Care should be taken to exclude light. Strong tinned cans would be convenient vessels to send the milk.

2. Samples of gutta-percha or of caoutchouc, prepared in as many different ways as possible, such as with the aid of (*a*) artificial heat; (*b*) hot water; (*c*) natural heat; (*d*) alum; (*e*) liquor ammonia; (*f*) acetic acid (?); (*g*) any plant, and also sending a small quantity of the plant so used; (*h*) fresh water; (*i*) salt water; (*j*) burning sulphur, taking care to note the time occupied, and all the steps of each process, using in every experiment an uniform quantity of the same milk.

3. Samples of the whey-like substance which separates from the caoutchouc and gutta-percha during its coalescence.

4. Samples of prepared caoutchouc and gutta-percha in the form or forms proposed to export it in, care being taken that it is as clean and dry as possible.

5. Information on the average yield of each kind of tree, and at different seasons, the best season for collecting, and the relative yield by simple tapping, (*b*) tapping, assisted by binding, and total destruction. Of course in practice the two latter methods should not be resorted to. A specimen of the stem, showing methods of tapping would be interesting.

(*g*) Woods likely to be useful in ship-building, for railway sleepers, in house construction, for cabinet work and engraving, showing them by a horizontal section with bark attached, about six inches thick or less; a slab from the centre, and also from the sap, and two or three billets 2½ inches square, 2-3 feet long from sound wood, so as to show figure, grain, lustre, colour, &c. They should not be varnished or polished. Information as to whether quick or slow growers, size, natural age, liability to insect attacks. The roots and boles are often useful for ornamental work.

(*h*) Substances used for perfumes and incense, for miscellaneous purposes, and customs connected therewith.

B.—Botanical specimens, as—

(*a*) Dried specimens of a branch of the tree, having the leaves, flowers, and fruit attached (loose flowers should be secured to prevent mixing), and fruits if liable to split open to be secured with string or wire to prevent shedding of seeds. The plants may easily be dried between sheets of any porous paper, care being taken to change the paper a few times at first, till the plants are perfectly dry. The specimens should be as characteristic as possible; leaves on different parts of a tree vary in some instances very considerably. Also sections of the stem with the bark on.

(*b*) Specimens of leaves, flowers, and fruits, attached, preserved in a jar or bottle, in some spirit, as brandy, spirits of wine, or in acetic acid, or a solution of salt, care being taken that the mouth of the vessel be well secured to prevent leakage.

(*c*) All the botanical specimens and the products should be gathered from the same identical tree.

(*d*) When there is more than one kind of variety of tree yielding the same substance, complete specimens of each kind should be collected and sent.

C.—Information as to—

(*a*) Vernacular names, whether generic or specific, whether the same name or different names are applied to the tree and its products; whether applied to other trees; their meanings and derivations, whether pure vernacular, a corruption, an introduced or commercial name.

(*b*) Early navigation, trade routes, commerce, locality where produced; how products are obtained and prepared; if the products of different species are mixed or not, the quantities suppliable; number and distribution of the trees, effect of collection on life of plant; price, means of transport, and data on which any such opinions are based.

D.—Climatic conditions under which the plant grow best as—

(*a*) Meteorological observations as to heat, humidity, elevation, &c.

(*b*) Soil in which each tree grows; whether they grow in exposed or sheltered spots; solitary or in clumps; on the skirts or in the depths of forests; by river banks or savannahs, &c.

Parcels of seeds, or live plants or cuttings should always be sent if obtainable, as such a collection of live plants would be highly interesting and valuable.

II.—*Animal Products.*

Used as or for—

A—Food,
B—Saccharine substances, as honey,
C—Furs,
D—Perfumes,
E—Fats and oils,
F—Skins, parchments, leather, &c.,
G—Hair, bristles and feathers,
H—Horn, ivory, bones, &c.,
I—Dyes and pigments,
K—Silk,
L—Shells,
M—Corals, sponge, &c.,

Also specimens, alive or preserved, of the animals giving these various substances.

III.—Mineral Products.

Such as gold, silver, copper, lead, tin, iron, and other minerals and rocks obtainable; sections of mines and strata, specimens of soils, &c., and any other geological information.

IV.—Machinery Manufactures.

Illustrations or models of—

A—Native agricultural and mechanical tools and implements,
B—Textile manufactures as cotton, silk, &c.,
C—Wood work as turning, cabinet work, ship-building,
D—Stone work,
E—Rope and basket making, coopering, dyeing, painting, &c.,
F—Paper-making, printing, book-binding, &c.

V.—Ethnology, &c.

Illustrations or models of—

A—Clothing, dwellings, weapons, domestic utensils, &c., skulls, &c., illustrated by drawings or photographs if possible. Also information on manners, customs, religions, &c.
B—Antiquities, such as old buildings, temples, remains, &c.

VI.—General Natural History Collections, such as Insects, Birds, Shells, &c.

All information given on personal knowledge should be distinguished from that given on the testimony of others.

Great care should be taken that the labels should be correctly and securely affixed to the specimens, and that the letter or other account should coincide with the numbers or names on the specimens.

For mineralogical specimens small canvas bags are better than paper, and, if packed lightly with paper or grass, will travel well.

Vegetable or animal substances should have camphor packed with them, as a preservative from insects.

Vegetable substances can be preserved wet in strong brine or spirit.

Small animals can be preserved in spirits, larger ones can be skinned and the skins rubbed over with arsenic paste or corrosive sublimate, alum, pepper, &c., but plain white arsenic is by far the best.—*Society of Arts Journal.*

THE SOUTH AUSTRALIAN WHEAT HARVEST.

THE South Australian harvest of 1878-9 will hereafter be referred to as the third of a series of harvests ranking in yield per acre considerably below the general average of such events in that colony. The *Observer's* correspondents have sent in their annual returns, and our contemporary has summed up the results, and drawn therefrom certain conclusions. Foremost among these is an estimate of the total area reaped for wheat this season; this is given as 1,286,355 acres, or 122,709 acres in excess of 1877-8, which in its turn showed an excess of 80,697 acres over 1876-7. The total yield is estimated at 9,007,624 bushels, which is equal to an average yield of 7 bushels and a minute fraction per acre. This return then, if realised, will not be the lowest the colony has seen; the yield last year was rather better, *viz.*, 7 bushels 46lbs. per acre, but the year previous it was only 5 bushels 24lbs. The total yield this year is thus less than that of last year by 27,068 bushels. Allowing for seeding at a less thick rate than formerly, there will be required for seed some 1,410,000 bushels. Formerly, it is observed 1½ bushels per acre was allowed, and more lately 1¼ bushels, "but as thin sowing is more generally adopted it is believed that an allowance of 1 bushel per acre will be ample." Estimating that 1,300,000 bushels will be required, at the rate of 5 bushels per head, to feed a population of 260,000, "there will be left available for export 6,297,624 bushels, representing in round numbers from 150,000 to 170,000 tons of wheat." In analysing the returns, our contemporary finds an immense disparity of yield; the local averages ranging from 2½ to 12½ bushels per acre. We do not notice any statement regarding high individual yields, but one of 30 bushels is mentioned as belonging to the previous year. It is evident, however, that a great proportion of land must have yielded nothing in districts affording the lowest and intermediate averages, and as results of a similar character must have occurred in each of the two preceding years, a vast number of those engaged in wheat production must stand badly in need of the concession they have asked of the State.—*Australasian.*

OWING to its heavy rain-fall, Aboo is, as regards vegetation, by far the richest part in Rajputana. On the higher parts of the mountain, humid types appear which are unknown on the plains below. Most noteworthy of these is an epiphytal orchid (a species of *Aerides*) which clings to the mango trees, and in the rains produces fine *racemes* of delicate pink flowers. The occurring of a charming white wild rose and of a stinging nettle, also at once reminds the visitor to Aboo that he has left the arid region below, and recalls to his mind the semi-temperate vegetation of the Himalayas and Nilgiris. Magnificent trees of *Michelia champaca* are found, especially besides the temples, and weeping willows adorn the margin of the lake near the station; but the latter two species have both doubtless been planted. A yellow jasmine abounds on Goroo-Sikhur, the highest peak of the mountain; but this is also doubtfully indigenous. *Cratæva religiosa* with its creamy yellow flowers and delicate tinted stems is common on the middle and lower slopes of the hill; while *Carissa caraudus* is so abundant that during part of the hot season its pretty white flowers scent the air for miles around the station with their delicious fragrance. The prevailing tree on the slopes of Aboo is the mango. It is doubtfully indigenous, and was probably originally introduced by the numerous pilgrims who have for ages frequented the sacred shrines for which the mountain is so famous. Now however, it is thoroughly naturalised, and is the commonest of the larger trees.—*Delhi Gazette.*

ON the banks of the Ka Wai Khyrwi, a river in Assam, there is said to be a peculiar growth of bamboos; the joints tending abnormally downwards, and the leaves shooting upwards, instead of drooping. And the fact is not only asserted but explained also by a story which might prove interesting to Mr. Ralston or Max Müller.. One day, about three or four hundred years ago, a man who dwelt in those parts, and earned a livelihood by working in the fields, went down to the river to fish, for a change. A large fish that he caught became transformed into a beautiful maiden. He married her and had two daughters, from the youngest of which sprang the Rajahs of Jaintia. But after the birth of the second daughter the fish-woman grew tired of her life and returned one day to the waters of Ka Wai Khyrwi. Her husband went with rod and line to re-capture her; but she dragged him in and the fishing rod stuck, point downwards in the river bed, and took root and grew—wherefore to this day the bamboos on the banks of the Ka Wai Khyrwi, grow upside down. The Raj of Jaintia, already noticed, was annexed in 1835, the Rajah having sacrificed a British subject to the Goddess Kali.

Lentils (vern. *masur*) are growing: the barley is well into ear; the wheat ear is also forming—the crop will be less than in former years, but there will be ample to enable the cultivators to tide over, until the autumn crops are reaped. Where the ground has been well and continously manured the crops are flourishing and will yield a full return. To show how great has been the drought of the past winter, I may mention that where wheat was sown late (December) last year, it has only *now* commenced to sprout, *i. e.*, after the snow that fell at the beginning of the month. The new grass is sprouting and looking delightfully green. Clover is coming into flower.

CAPTAIN STRAHAN, R. E., notices some large artificial lakes in the Aravalli Range; one lake indeed he believes to be the largest of the kind in India. He writes:—"A very notable feature in the Aravalli is the number of artificial lakes, some of them picturesquely situated; the principal ones are the Dhabar, or Jai Samand, the Rae Samand, the Uday Sagar, and the Pichholla at Oodeypore. They are named in order according to their size. The Dhabar, which is perhaps the largest artificial lake in the world, is nearly 9 miles long by upwards of 5 miles wide, and covers an area of nearly 21 square miles, of which 0·8 square mile consists of islands. The area drained into it is 690 square miles. Its greatest depth was 78 feet, which was just before entering the range of hills which from the south-west edge of the lake to the dam I found to be 62 feet. The Rae Samand I visited on the march down, and have also calculated its area, &c., from maps. Its length is 3 miles, width 1½ miles, area 2·9 square miles, and area drained into it is 194 squares miles,

The Uday Sagar is nearly 2½ miles long by 1½ wide; its area is 2 square miles, and it drains 179 square miles of country. The Picholla is 2½ by 1½ miles; its area 1·2 square miles, and drains 56 square miles. The stream which has been dammed up to form this lake originally joined that flowing into the Uday Sagar; two other small lakes, the Basi and Derali, between them draining 15, square miles, also stop some of the drainage into the Uday Sagar which otherwise would be the second largest lake. Thus these four lakes alone hold in their basins the drainage of 1,127 square miles of country. The water is utilised somewhat for irrigation, but not to any large extent."—*Pioneer*.

A case which recently occurred at South Norwalk, Conn., United States, where three persons in one family died in consequence of drinking water from a well tainted by drippings from a cesspool, ought to be a warning to all persons to beware of the typhoid poisons, sure to be found in wells near dwellings, if any of the house drainage can percolate to them. The gelatinous matter often found upon the stones of a well is poison to the human system. Wholesome water is always odourless and colourless. To test its purity thoroughly, place in it a few grains of lump sugar and expose it to the sunlight in a window. Should the water became turbid, even after an exposure of eight or ten days, it is a proof that it has been contaminated by some kind of sewerage. If it remains perfectly clear it is pure and safe. Such an experiment as this costs nothing to make; but it would be well if all families who have the faintest reason to suspect that their drinking water is impure would take this way to ascertain the truth of the matter, in order that they may provide in time against the insidious and deadly poison contained in all water contaminated with sewerage. The above article, clipped from a northern newspaper, is of special importance. The writer, on seeing the above suggestion some years since, tested the water from his wells by taking a clear white glass bottle—a Florence oil flask is best—and placed it with water and sugar in the sunlight, well corked, and soon found the water to become turbid. He then put some pure rain water to the test, and found it to remain unaltered. He immediately sank two wells, at a considerable distance from his house, the last of which stood the test perfectly. In addition to this, he built a large cistern of brick and cement, and had has the satisfaction of knowing that his family are not poisoned by such impurities of water as quite too many of our citizens are now suffering from.—*St. Augustine Press.*

THE GARDEN.

THE Dutch official trade returns show that the export of flower bulbs during the sixteen years from 1861 to the end of 1876, amounted in value to 19,640,000 Dutch florins, (about £1,636,000), or an annual average of over £100,000. It appears that the value has been annually rising; thus the export for 1876 is set down at 1,666,000 florins (nearly £139,000). According to the latest survey the land devoted to rearing bulbs of tulips, hyacinths, and similar flowers amounts to 240 hectares, or nearly 600 acres. Of these about ten acres are in the neighbourhood of Egmont, about ninety around Velsen, while the remaining 500 acres are in the neighbourhood of Haarlem, Schoten, Blœmendaal, and Heemstede. But besides these special localities, where the cultivation of the bulbs is carried out on a large scale, there are innumerable small patches scattered all over the country where tulip and hyacinth bulbs are reared with great care and success.

OF fruit trees there are the apricot with its red and white petals: the peach with its pink petals: the cherry and quince with their white blossoms: the apple (about a month late this year) with its delicate pink and white blossom almost as charming as a young maiden's cheeks; this year will not be a good one for apples which only come in plenty every other year; last year being a bumper season, this year will give us less, and the vine, which is just bursting into leaf.

In gardening matters all kinds of flower seeds are now being sown: pinks, the tulip crocus, and other perennials transplanted. Onions transplanted, potatoes, peas, &c., sown. Paths are being put into repair.—*Deccan Herald.*

THE AGRI-HORTICULTURAL SOCIETY OF SIMLA.

THE following prospectus has been issued by this Society:—"The Agri-Horticultural Society of Simla have resolved on extending their sphere of usefulness, and with this view are in treaty for the lease, with option of purchase, of the property known as 'Blessington' situated under the shop of Messrs. Symes and Co., and therefore in the most central position in Simla. They purpose to supply a generally acknowledged want by laying out these extensive grounds as a pleasure garden, which will be open to subscribers, a large plot being reserved as a lawn for *fêtes*, flower shows, and other public purposes. In these grounds fruit and ornamental flowers will be cultivated for distribution, and experiments undertaken in horticulture, agriculture and arboriculture. The Society purpose holding annually, commencing with the year 1879, three flower shows: during the last week of May, the second in August, and the third about the end of September or beginning of October. With a view to the improvement of vegetables now cultivated in the neighbourhood of Simla, and to encourage the cultivation of other European vegetables, the Committee propose to hold monthly shows in the New Market or some other convenient place, at which native producers only will be allowed to compete. During the winter an order will be sent to England for flower and vegetable seeds, plants, bulbs, &c., which will be sold to subscribers at cost price. Orders will be registered for any special articles required by subscribers. In order to carry out the above objects, a considerable sum of money will be required for initial expenses, though it is hoped that eventually the garden will be self-supporting. The Committee trust, therefore, that they will receive liberal support from the public of Simla and of the Punjab generally in their undertaking. The subscriptions have been fixed to the sum of Rs. 10 annually, and *it is hoped that in addition to subscriptions for 1879, which are hereby invited*, all residents and house proprietors of Simla will contribute a substantial donation towards the first heavy expenses which must devolve on the Society. The Committee invite contributions of plants in order to stock their garden for the approaching season." Major Henderson is the Honorary Secretary whose signature is appended to this notification. The first of the flower shows announced was held on the grounds of his house, "Dahlia Lodge." Unfortunately the first heavy shower of the *chota bursat* coincided with the exhibition, which was consequently attended by a very small number of persons, and robbed of the attractions of the Viceroy's band, which was to have been present. Nor was the show of flowers at all remarkable.

SUGAR CONTAINED IN THE NECTAR OF VARIOUS FLOWERS.

THE sweet-tasted fluid which is secreted within the cups of insect-fertilised flowers is called nectar, and the object gained to the plant by its presence is that insects, induced to visit flowers for its sake, are useful to the plants by effecting a cross-fertilisation. In many instances this sweet liquid is exuded from special glands, but in other cases from portions of the flower which do not seem to have been specially adapted for this purpose. It is a point in dispute amongst biologists whether this saccharine matter is a true secretion, or simply an excretion of effete matter from the vegetable cells—a bye-product of the chemical changes taking place within the cells. The latter view seems to be favoured by the fact that a similar sweet-tasted fluid, much sought after by insects, is exuded on the different parts of some plants quite unconnected with the flower, as in the laurel, brake, fern, lime tree, acacia, &c. The bright colours, as shown by Lubbock's experiments, serve to guide insects to the flowers, and the odours which they emit fulfil the same end. The importance of these guides to insects will be apparent from the following estimations, which show how indispensable it is that as little time as possible should be lost by an insect collecting honey. The formation of nectar is observed to take place most freely in hot weather, and to be prevented by cold or wet. By biologists, the visits of bees, butterflies and other insects are believed to have exercised in past times an important influence in modifying the size, shape, colour, &c., of flowers; and the following experiments are of interest as showing to what an extent this action takes place in nature, and as helping to determine the value of this factor. The nectar was extracted with water, and the sugar determined, before and after inversion, by means of Fehling's copper solution. In the case of fuchsia—which is not deprived of its nectar by any insect in this country, the nectar being inaccessible to native species—we have probably the whole amount formed, but in other cases the visits of bees, &c., may have reduced the amounts considerably. In this case it is a clear colourless liquid, having an acid reaction and an intensely sweet taste; that of many others has the strong characteristic odour of honey.

SUGAR IN FLOWERS.

	Total gram.	Fruit sugar.	Cane sugar? (as fruit).
Fuchsia, per flower	7 59	1·69	5 9
Claytonia alsanoides, ditto	0·418	0·175	0·238
Everlasting pea, ditto	9 93	8·83	1·60
Vetch (*Vicia Cracca*), per raceme ...	3·16	3·15	0·01
Ditto, per single flower	0 158	0·158	—
Red clover, per head	7·93	5 95	1 98
Ditto, per floret	0·132	0·099	0·033
Monkshood, per flower	6·41	4·63	1·78

Approximately, then, 100 heads of clover yield 0·8 gram sugar, or 125 give one gram, or 125,000 one kilo of sugar; and as each head contains about 60 florets, 7,500,000 distinct flower tubes

must be sucked in order to obtain one kilo of sugar. Now as honey roughly may be said to contain 75 per cent. of sugar, we have one kilo equivalent to 5,600,000 flowers in round numbers, or say 2½ millions of visits for one pound of honey. This shows what an amazing amount of labour the bees must perform. Another point worth notice in these results is the occurrence of what appears to be cane-sugar, and in the case of *fuchsia* in the proportion of nearly three-fourths of the whole. This is remarkable, as honey is usually supposed to contain no cane-sugar, the presence of the latter being usually regarded as certain evidence of adulteration. The question therefore arises whether this change, which takes place while the sugar is in the possession of the bee, is due to the action of juices with which it comes in contact while in the honey-bag, or expanded œsophagus of the insect, or whether the process of inversion goes on spontaneously, as may perhaps be the case.—A. S. WILSON, in *Chem. News.*

STRAWBERRIES.

IMMENSE quantities of strawberries are consumed annually in Paris, and although the extent of market garden ground devoted to their cultivation in the nighbourhood of the capital is very large, it would, by itself, be wholly insufficient. In spite of the difficulties attending the transport of so delicate a fruit, most supplies are brought by rail from great distances and one source from which a considerable quantity is obtained is a place called Plougartel, (Finistere) not far from Brest.

The fruit is grown there under conditions which, at first sight, would not seem to be at all favourable to the cultivation. The sight selected is the level fields or downs, at the top of the cliffs close to the sea, and their limits but rarely exceed a distance, of 600 metres in land. Further from the sea the flowers are likely to be destroyed by the late frosts, and moreover, as the winds are stronger and the fogs less intense, the earth dries up quicker. The fields on the cliffs are divided into squares containing about 50 metres, and bounded by hedges or low walls of loose stones, which shelter the plants from the wind, and, at the same time, retain a portion of the solar heat they receive. The extent of ground occupied in this cultivation is very considerable, as it forms a belt round the whole of the bay. The gathering of the fruit generally commences about the 20th May, and terminates, for those to be sent away, about the 24th June, but is continued for local consumption until the middle of July. The quantity of strawberries sent away is of course known, but to estimate what are locally consumed is almost impossible; probably in no place in Europe are so many eaten as in Brest and its environs. They are on every table, from the highest to the lowest, at each meal, and great numbers are lost for want of hands to gather them. At the end of the last century and the beginning of the present one, the cultivation of strawberries at Plougartel was limited to a local supply, but since the construction of railways it has taken a great extension. According to a report lately read at the Quimper Agricultural Show, the ground occupied in this industry is 500 acres. In 1875, Plougartel sent to Paris 2,000,000 kilos, of strawberries, as against 1,650,000 kilos the previous year. The consumption of the nearest towns—Brest, Landernean, Morlaix, Lorient, Quimper, Nantes, &c, represents a further amount of 1,800,000 kilos. Therefore the 500 acres produce a total of 3,800,000 kilos, equal to 7,000 kilos per acre, which sell at 20 cents the kilo, equal to 630 francs the acre The costs of cultivation are calculated at 250,000 francs, consequently a very considerable profit is gained by the growers.

KULHUTTY GARDENS ON THE NEILGHERRIES.

THE superintendent of the Government Botanical Gardens, Neilgherries, forwarded the following remarks to Government on the 6th March last:—

In the report on the Horticultural Gardens at Ootacamund, for the year 1858, the superintendent states that the nursery at Kulhutty contained perhaps the most extensive stock of apple, pear, plum, peach, fig, almond, mulberry, raspberry, nectarine, apricot, vine, loquot, lemon, citron, and pineapple plants at that time to be found in India. In forwarding this report to Government, Dr. Cleghorn proposed to eventually abolish this nursery garden, as only two gardeners were employed, and these were not sufficient to keep the garden clear of weeds. This proposition was approved by Government.

During the following eleven years apparently little or nothing had been done to maintain the stock of fruit-trees for, on my visiting the garden early in 1869, there were very few of these plants to be found in the nurseries, and with the exception of about one acre (devoted exclusively to the cultivation of vegetables and flowers for seed) the garden was in an abandoned state, and had more the appearance of natural jungle than a nursery garden. The large stock of plants enumerated in the superintendent's report must have therefore either died out or been disposed of and not renewed.

Adverting to the extract from the report on the Horticultural Gardens for 1858, alluded to in paragraph 2 of Government Order above quoted, I am quite certain that the superintendent's expectations in regard to the acclimatising and growth of European fruits were never realised, more especially with reference to the finer kinds of stone-fruit, peaches, nectarines, plums, almonds, &c., and as for currants and filberts there is ample proof that they will not live, much less thrive at Kulhutty. The late Mr. McIvor informed me that he had persevered in the cultivation of these fruit-trees, trying them in all manner of situations and under the most varied conditions, but without success and had finally to abandon their cultivation as hopeless.

During the period the garden has been under my charge, I have imported grafted peach, cherry and plum trees, and have also had imported scions grafted on the common peach and cherry, but the growth was anything but satisfactory. During the first and second year after grafting, the young trees make a vigorous and healthy growth, but by the end of the third year they become stunted and bark-bound, having apparently exhausted all the vigour of the stock; should they produce blossom buds during the fourth year, not more than one-third of the buds expand, and, if any fruit set, they invariably drop off during the stoning period.

After seven years' experience I have come to the conclusion that the climate of Kulhutty is too hot, the subsoil too dry, and the season of drought too prolonged, ever to produce the finer kinds of stone fruit. On the other hand, however, it is admirably adapted to the growth of all the citrus family, orange, lime, lemon, &c. Some varieties of fig, loquot, and pomegranate thrive equally well.

There is no doubt but the nurseries at Kulhutty are valuable to the Ootacamund Gardens for the propagation of a young stock of fruit-trees, and might be more largely utilised than they have been. Seeds germinated earlier, grafts of all kinds take more readily there than in the colder climate of Ootacamund The young plants should always be sold off within the second or third year from date of sowing or grafting, or they become too large for removal.

I took charge of the garden in 1872, and since then have raised and distributed a considerable number of young fruit-trees and other plants from these nurseries.

Three years ago the terrace revetments were repaired, the trees pruned and cleared of parasites; but the number of gardeners allowed is not sufficient to keep the garden in thorough order, as their time is mostly taken up in watering the young plants in the nurseries and keeping down the weeds, which grow very rapidly at Kulhutty.

Several experiments have also been undertaken in the cultivation of cotton, American maize, cholum, coffee and the cochineal, cactus plants, &c.; some have succeeded and others failed.

The fruit-trees at present in the garden comprise the commoner varieties of apple, orange, lime, pumaloe, peach, fig, pear, pomegranate, &c., &c., but not having been pruned or manured for some time they are all more or less overrun with parasites and yield very poor crops of indifferently flavoured fruit.

My reason for recommending the sale of the garden at Kulhutty was simply to provide funds to enclose and protect the more valuable Government property (Sim's Park) at Conoor. However, if Government do not approve my recommendation, but wish to retain the garden as a branch of the Ootacamund Garden, I would respectfully beg leave to submit the following suggestions:—

That the garden be thoroughly overhauled, the nurseries manured and stocked with young fruit-trees and such other plants as are known to thrive at Kulhutty.

That the old and decaying fruit-trees be uprooted and replaced by healthy young ones.

That plants of all the different varieties of orange cultivated in India of Europe be procured and planted in the garden.

That a few acres be cleared of scrub and planted with peppermint colycinth, datura, and such medicinal plants as do not thrive well at Ootacamund.

That a small area be planted with the valuable *Cinchona calasaya*, var. *ledgeriana*, as I am confident this variety will thrive and produce seed at an earlier age at Kulhutty than at Ootacamund or Neddivuttam.

That a sufficient number of coolies be employed to keep the garden in good order.

That the present stock of the cochineal cactus be planted as a fence around the nurseries, so as to have plants on the spot, if the cochineal insect should ever be introduced.

That the stock of young fruit-trees left unsold at the end of each year be disposed of by auction.

When the fruit-trees come into full bearing, the produce of the garden would, I have no doubt, command a much higher figure than at present. The revenue derived from the sale of drugs alone would in a few years cover the whole expenditure incurred in putting the garden in thorough order.

Should you approve my suggestions, I beg you will be so good as to recommend Government to sanction an outlay of Rs. 250, (in excess of the Rs. 150), already sanctioned in G. O., No. 46, of the 10th January last. This sum would enable me to carry out the improvements and stock the garden with plants during 1879-80.

Mr. Jamisson's proposals are generally approved, and the proposed additional expenditure to give effect to them is sanctioned.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

Monthly General Meeting held on Thursday, the 22nd May 1879.

THE HON'BLE LOUIS S. JACKSON, C.I.E., *President, in the Chair.*

THE proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members :—

Mr. Louis de Saint-Hilaire, Baboo Shiv Partap Narin, and Managers of the Arcuttipore Tea Company, Cachar, and of the Hathighor Tea Estate, Mungledye, Assam.

The names of the following gentlemen were submitted as desirous of joining the Society :—

Captain A. Evans Gordon, Deputy Commissioner, Chittagong Hill Tracts,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

A. B. L. Webb, Esq., Manager Lloyd's Bank, Darjeeling,—proposed by Mr. W. H. Cogswell, seconded by Mr. W. Stalkartt.

Superintendent Government Horticultural Garden, Lucknow,—proposed by the Secretary, seconded by Mr. Leitch.

Manager of the Awa Estate, Agra District,—proposed by Mr. E. Buck, seconded by the Secretary.

H. Meyer, Esq., Cootahi Factory *viâ* Baraitch, Goruckpore,—proposed by Mr. W. B. Carshore, seconded by the Secretary.

Lieut.-Col. W. B. Thomson, Deputy Commissioner of Dumoh, Central Provinces,—proposed by the President, seconded by Mr. S. H. Robinson.

Dr. A. E. Dalgairns, 7th Regiment M. N. I., Berhampore,—proposed by Mr. W. F. Grahame, seconded by the Secretary.

Rejoined.—J. Buckingham, Esq., Manager, Amjoore Tea Estate, Assam.

CONTRIBUTIONS.

Some nuts of the "Coco-de-Mer" (*Lodoicea seohellarum*) and seeds of other palms,—from Director of the Royal Botanic Garden, Mauritius.

A few seeds of *Amherstia nobilis*,—from Major Fanshawe.

A collection of plants and seeds from the Andamans,—from E. H. Man, Esq.

Seed of *Pithecolobium saman* and teak,—from the Superintendent of the Royal Botanic Garden, Calcutta.

Some acclimatized American maize seed, nearly equal to imported stock,—from Dr. S. Lynch.

A few tubers of Gesnera, Achimines, and Tydæas,—from Dr. T. Beaumont.

Seed of *Eucalyptus barleyana*, and of a thorny melon bush (*Acanthosicyos horrida*),—from Baron F. von Müeller.

Some seed of the "Forbidden fruit," of shaddock and orange,—from Colonel W. M. Lees. (Germinated freely.)

Some cakes of "Umwut" or "Amsutu,"—from Baboo Srimohun Thakoor of Berari, Bhagulpore.

The Baboo gives a note of the mode of preparing these mango cakes, which he describes as superior to what are generally prepared. He uses the finest Bombay mangoes for the purpose, unadulterated with any other ingredient.

GARDEN.

The Head Gardener's monthly report was read, of which the following is an extract :—

"The late unusual dry weather, which may continue for some time yet, has severely tried the plants in the garden ; many palms have either died, or are about dying for want of water, and the general collection of plants have suffered proportionally. We have a project just now in hand for deepening our tanks, which, in connection with channels from different parts of the garden grounds, will ensure a more copious supply of water to be stored up for future use ; in fact, we can hardly have too many tanks in a garden. Labour has chiefly been utilized in watering, digging channels, potting off young stock, seed-sowing, and other minor works. The new plant-house is progressing, and will, I think, be of considerable service when finished ; we must, however, have a shower or two of rain on the flooring to settle it firm before roofing it. We have been supplied from the Commissariat cattle-sheds with a large quantity of useful manure, which will prove valuable for application to our new orchard, as the trees will be benefited thereby. I herewith add a list of seeds contributed since last report, also noting which have germinated. All the following seeds were sown in the ordinary manner, except the double cocoanut, for which pits 3 or 4 feet in depth were dug, the soil again replaced to within a foot of the original surface, the nut laid in position on its side, placing the widest sinus downwards to allow for the passage of the rudimentary parts of the young plant (which, when they germinate, will meet with no obstruction in downward course), which I understand grows to the length of 3 or 4 feet before emitting the primary leaf. [See page 240, *Williams' Ornamental Leaved Plants*, Vol. II, Ed. 1876.]

"We have also secured about 19 Liberian coffee berries yesterday, which were duly sown.

"Mr. Gleeson adds that some of the seeds referred to under the contribution head, have germinated ; others have not been sown sufficiently long to report on. The seeds of *Amherstia nobilis* from Major Fanshawe, have unfortunately failed.

APPLICATIONS FOR SEEDS.

Letters were read—

From Capt. Evans Gordon, Deputy Commissioner, Chittagong Hill Tracts, applying for Carolina paddy and tobacco seed. (Complied with.) Capt. Gordon mentions that he has this year planted out "about four acres of seedlings of Havanna, Manilla, Shiraz, Sandoway, and Delhi, and the plants which have grown most luxuriantly are now under process of curing. I am anxious to obtain some Carolina paddy. If you will assist me in this, I shall feel much obliged, as I should like to give it a trial here this rains. I hope to submit samples of the tobacco grown here, as also of the other plants and trees, &c., with which we are making experiments."

From the Superintendent of Revenue Survey, Bhownagur, applying for Bamia cotton seed, for trial in that part of Kattyewar, and instructions for raising it, and promising to communicate the result. (Complied with.)

From Major Jacob, Executive Engineer, Jeypore State, applying for seed of *Pithecolobium saman*, (Complied with). "I have been much interested," observes Major Jacob, "in the paper on *Pithecolobium saman*, page 34, Vol. VI of the Society's Journal. It appears to me that this would be just the sort of tree for Rajpootana, and I am very anxious to give it an extensive trial. I write to ask if you can favour me with a large supply of seed, or inform me how it can be got. I shall be happy to take as much seed as I can get on payment if necessary. Also, I shall be glad, if you would kindly favour me with simple directions as to the best way to treat them : time and manner of sowing, and management afterwards. If you can help me in any way, I shall be greatly obliged."

From J. H. Bridgman, Esq., Goruckpore, on the subject of seeds of sundry useful plants. The following is an extract of Mr. Bridgman's letter :—

"I have to thank you for a packet of the *Pithecolobium saman* seed, which reached me ten days ago, and for which I am much obliged. It was followed by the number of the Agri-Horticultural Society's Journal referred to in your note, where I found, in the page indicated by you, an account of this very valuable tree. If it will vegetate and thrive in this part of the world, a great benefit will have been gained.

"Mr. Buckland, the gentleman in charge of my indigo factory of Bella Hariya, Lehra, has grown successfully the *Reana luxurians*, and has an abundance of seed. I need not, therefore, trouble you for any. The *Reana* is an annual, and requires cultivation and irrigation for its growth. What we still want is a deep-rooted perennial grass that will grow spontaneously, and of which the leaves will afford good pasture to cattle. I say 'deep-rooted' because it is only a deep-rooted grass that, finding moisture for its sustenance in the subsoil, will give leaf in the hot season. Those deep-rooted wild grasses of this country with which I am acquainted, all yield a leaf too coarse and harsh for cattle to feed upon ; and if a grass, such as I have described, which they would eat, could be found, the discovery would be invaluable. In a letter from the correspondent of the *Pioneer* with the Thull-Chotiali force, published a few days ago, the writer spoke of the excellence of the beef and mutton, and the thriving condition of the cattle of that country, which he attributed to the good quality of the pasture grass prevailing there. That must be a very dry country, and it seems probable that a grass growing well there would also thrive in these provinces. I suggest that some of the seed should be procured, if practicable, for the purpose of experiment in the Benares province.

"Since I last wrote to you I have lighted upon an extract I made from the *Pioneer* of the 9th of October last, descriptive of another valuable tree, of which the cultivation is suggested. It is called *Catalpa bignonioides*, and is described as 'possessing a lovely flower,' and as being 'most valuable for the lasting qualities of its wood.' It is easily propagated, grows rapidly in almost any soil, and, so far as is known, is free from the attacks of insects. 'The wood also, besides durability, possesses beauty to a considerable extent, its general colour being a warm buff, taking a fine polish, and being well adapted for cabinet work.' If you have any seeds of this tree, I shall feel greatly obliged if you can spare me a few."

The Secretary mentioned he had applied to the Society's seedsmen at Philadelphia for seed of this *Catalpa*.

From E. Buck, Esq., Director, Department of Agriculture, N.-W. P., applying for certain varieties of spring wheat. (Application put in hand.)

From Baron Ferd. von Müeller on the subject of *Reana (Euchlæna) luxurians*. "Let me thank you for your kindness," writes the Baron, "in forwarding so liberal a supply of seeds of the *Euchlæna luxurians*. This enables me to push this plant further through Australia than I could do two or three years ago. I have sent for seeds of *Festuca dives* to the fern tree gullies of our mountains, the nearest place to get them being 40 miles distant ; I hope to have them for the next mail. The seeds of *Araucarias* I have ordered from Queensland. Australia being a continent almost as large as Europe, I need hardly say that for some years we can never get too much seed of such a superb grass as the Teosinté [*Reana*] for distribution."

The Secretary stated he had despatched a further and larger supply of the *Reana* seed.

COMMUNICATIONS ON VARIOUS SUBJECTS.

Communications were submitted—

1. From Assistant Secretary, Government of Bengal, P. W. D., Irrigation Branch, applying for information in respect to the proposed cultivation of cocoanuts on the Midnapore and Orissa canal banks, as the Lieutenant-Governor is willing to sanction an annual sum for such purpose. (Information given.)

2. From Captain J. F. Pogson, on the subject of a medicinal garden at Koteghur. The following is an extract of Captain Pogson's letter:—

"I am much in want of some *Digitalis purpurea* seed, and if you could send me some I should esteem it a favour and be greatly obliged. I have the yellow fox glove, but want the other, as it is the right kind for medicinal purposes.

"I think all or nearly all, the medicinal plants of the pharmacopœia may be made to grow to perfection in these parts, and I have therefore decided on starting a medicinal plant garden. I am gradually getting in seeds and roots, but I do not know where to obtain certain seeds from. Of these *Momordica elaterium*, called 'spirting cucumbers' and 'wild cucumber' is one. It is stated to be peculiar to the south of Europe, and that is all my present information. On looking at a chemist's list, I find its preparation 'Elaterium,' priced wholesale at Rs. 18 per ounce. Extract Chiretta is down at Rs. 20 per lb., and 'Aconite Ang' is Rs. 15 for a dram. 'Atropia' is priced the same. Extract Belladonna is Rs. 6, and numerous other things which could be grown here in proportion.

"If the Society would help me in carrying out this project, the public would in a few years be greatly benefited. I do not want money but aid in obtaining seed and live roots, and this might be accomplished

through the agency of the various Horticultural Societies with which our Society corresponds."

Resolved—That Captain Pogson's requisition be placed on the proceedings with the view of eliciting information and help.

Captain Pogson adds—

"I may now mention that last year I wrote to Mr. J. F. Duthie on the subject of grafting the *Ficus elastica*, on the *Ficus indica* in order to make the latter act as milch cow to the former. Last month I heard from Mr. Duthie, who in answer to my question said the experiment, as far as the grafting went, was a success. But time was needed for its completion, which I presume means tapping the *Ficus elastica* for its milk. This experiment might now be repeated in the Society's and other gardens in and about Calcutta, and the hitherto useless banyan tree might be turned to very profitable account.

3. From the Superintendent of the Horticultural Garden, Lucknow, sending for analysis some bark of *Eucalyptus citriodora*. "The leaves of the species," observes Mr. Ridley, "are very sweet scented, and I found the bark was also slightly scented. It peels off in large pieces, and leaves the stems clean and white. I thought it might possibly be of some use, medicinally or otherwise, and if you think so, you could perhaps get it analyzed and ascertain whether it is of any value or not. The tree grows very rapidly here, and in time the bark could be produced in quantity."

The Secretary mentioned he had transferred this bark to the Secretary, Economic Museum, and it had been tested by Dr. Kannyelall Dey, with the following results :—

"I have submitted the bark of *Eucalyptus citriodora* you handed to me, to both physiological and chemical tests with the following results :

"A strong decoction prepared from the bark was administered to a cat, and the animal showed no symptoms of uneasiness whatsoever, hence I conclude there is no toxic property in the bark.

"I tried to find if there was any astringent property in the bark, but I found it contained more tannin than many barks of a similar nature ; but in comparison with babul bark (*Acacia arabica*) I find it contains less. On incineration it yields alkaline salts."

4. From the Secretary to the Government of Punjab, submitting copies of reports of Canal Officers on the experimental cultivation of *Reana luxurians* on canal banks in the Punjab in the year 1878, from seed supplied by the Society. (Transferred for publication in the journal.)

5. From P. Michea, Esq , Ghazeepore. Some useful notes on the production of sugar in the Benares district. (Transferred for journal.)

FORESTRY.

FORESTS, AND WHAT WE OWE TO THEM.

THE different standard of intelligence exhibited in the administration of the Imperial Government and that of our own could hardly be more strongly shown than by the fact that the Home Government has recently gone to great trouble to obtain and analyse complete returns regarding the condition of forests and timber supply in the colonies, and now has published them, just about at the time when our own Government has entered on a course that will lead to the destruction of our poor attempts at forest conservation just to please one or two political loafers and to secure one or two hireling votes. In the returns we refer to copious evidence is supplied of the ruinous destruction that is going on, and its reckless effects. In some prefatory remarks prefixed to them reference is made to cases where "strong and well-established Governments look on supinely while the timber is disappearing and the whole country is becoming treeless and bereft of the shade so necessary to health, and even to existence in tropical climates." We are further told that "in some cases something little short of a meteorological revolution has been caused by the extermination of the woods. Streams once regarded as perennial now run dry under exposure to a tropical sun, and the periodicity of the rainfall has been seriously disturbed in many localities. So many testimonies converge towards the establishment of a connexion between rainfall and forest area, that it is difficult to resist the conclusion that much which is gained by throwing a little more forest land into cultivation is lost in the lowered fertility and the disturbance of the climatic equilibrium of the whole district."

If anything were required to add weight to the important testimony and serious warnings which have been published upon this subject, it is supplied by the fact or, we will say, the probability that a cause is already at work in the same direction which is laying waste vast regions of the earth's surface—a cause which we cannot in any way remove, and in regard to which we have only to choose between co-operating with it, or striving to mitigate its effects. Some very extensive and significant evidence was collected some years ago by Professor J. D. Whitney, and published in the *American Naturalist*, to show that large tracts upon the face of the earth were undergoing dessication, that there has been, and is still proceeding, a great decrease of water on the earth, and that, if this process continues without limit, we are in danger of drying up. Observations in Central Asia, in Cashmere, in Thibet, point to a great dessication in those regions. Where great mountain lakes existed there is now nothing but arid valleys. At no distant time, geologically speaking, the valley of Cashmere was occupied by a lake. Even within historical times, the area covered by water in the basin of the Aral and Caspian seas has immensely diminished. In Africa ruins found in the great Libyan desert testify to great changes having occurred within historic times. Readers of Dr. Livingstone's travels will remember the evidence he so often cites of a rapid drying up of Southern Central Africa. In the great basin west of the Rocky Mountains, North America, in which the Great Salt Lake lies, there are terraces surrounding the lake to prove how much greater area it occupied in earlier times. In many other parts, such as Arabia, Persia, and even in Europe, there is cogent proof supplied that the quantity of water is much less than it was at earlier, and not always very remote periods. These effects are in many cases altogether too vast to be attributed to any destruction of forests even were there proofs that such forests had ever been destroyed. We seem to be thus brought in face of the formidable phenomenon of a gradual and most extensive dessication of the surface of the earth without any means of estimating to what extent it will proceed, and what, if any, will be its limit. And if this is so we have to choose between co-operating with this influence by destroying as rapidly as possible the forests which oppose this dessication, or to endeavour to counteract it by carefully preserving these as invaluable bulwarks against a terrible foe.

Let us now give a glance at what mankind have done, and are doing, in regard to these alternatives. An article by Mr. F. L. Oswald, in the *North American Review* for January, gives a telling summary of some of the leading facts which answer this question. The writer, after sketching the evidence proving the wholesale destruction of forest in the countries surrounding the Mediterranean, in the course of which he states that "since the beginning of the 16th century the population of the four Mediterranean peninsulas has decreased more than 55 millions," and "the rate of the decline from year to year bears an exact proportion to the decrease of the forest area of every district," proceeds :—

"Affghanistan, Persia, Mesopotamia, Syria, Asia Minor, Greece, Macedonia, the southern islands of the Mediterranean, and the whole of Northern Africa, from Cairo to the western extremity of Morocco—countries which were once blessed with abundance and a glorious climate—are now either absolute sand wastes or the abode of perennial droughts, hunger, and wretchedness ; and wherever statistical records have been preserved, it is proved beyond the possibility of a doubt, that their misfortunes commenced with the disappearance of their arboreal vegetation."

He goes on to show that in the western hemisphere the forest area has during the last 45 years decreased at the average rate of 11,400 square miles annually. In the United States the rate has advanced from 1,600 square miles in 1835 to 8,400 in 1876. "We have," he says "been wasting the moisture supply of the American soil at the average ratio of 7 per cent. for each quarter of a century during the last 125 years, and are now fast approaching the limit beyond which any further decrease will affect the climatic phenomena of the entire continent." There is much that is suggestive and significant, if also something that is rather fanciful, in the sentence, "The treeless regions of America lie chiefly in the west, those of Africa and Arabia in the north, of Europe in the south-east, and of Australia in the north-west ; and the theory that all deserts on the face of our globe have been produced by the hand of man is, therefore, supported by the remarkable circumstance that the most barren portion of four continents are found *on the side turned towards Asia*, and which, according to all geographical and ethnological probabilities must have been first reached by the waves of emigration which emanated from that common home of the human race." The writer's fancy again finds play in the observation, "But the interest we should take in the preservation of our woods might rest on even a broader basis than their agricultural importance. That man was not created in a desert nor in a cotton field or a city, but in a forest, is one of the few points in which Moses and Darwin agree ; and, with our forests, we would lose their health-giving atmosphere, the music of their song birds the purest enjoyments of our early years, and nature's remedy for the mental discords of mankind. Woods are the native life-element of the human race, and a home-sickness, an instinctive yearning after the garden home of our forefathers, haunts the nomad of the desert, as well as the inhabitant of luxurious cities."

It is not necessary for emphasising the immense importance of preserving a proper proportion of forest to linger on considerations such as these. Not that they are at all trivial. They are of great weight, and there can be no question that, even if it were possible without material injury to turn the whole land into a corn-field or a pasture, it would still be well in the interests of harmony and beauty, and their cultivating and soothing effects, to retain tracts of woodlands that might present to civilised man glimpses of the primeval nature he has quitted. But in comparison with the tremendous issues involved, not to the well-being, but to the very existence of mankind, these considerations become relatively of slight moment. The real question for a community settled in a new land to consider is, does it desire to retain the country as a home for future generations, and to preserve the climatic conditions, and the natural balance of forest and champaign by which it is fitted to sustain and nourish human life, or does it rather contemplate becoming a locust visitation to the land, destroying its wealth, rifling its resources, stripping it of its fertility, and leaving it poorer to each successive generation, until it finally remains a desert spot on the face of the earth, unfitted for ever to sustain vegetable and animal life ? Could the dread importance of this question once be realised to the public mind, it would be answered in a moment, and in such a way as would effectually prevent henceforth the wretched parasites of political life from wasting, to gratify their petty objects and ambitions, the natural treasures of the country, which, once gone, are never likely to be replaced.—*Australasian.*

TEAK FORESTS OF BURMAH.

THE following letter has been placed at our disposal:—From Colonel R. H. Beddome, Conservator of Forests, to J. H. Garstin, Esq., Acting Secretary to Government, Revenue Department, dated Ootacamund, 10th March 1879, No. 1,618-A.

Referring to the G. O. N. 1,903, of the 23rd November 1878, I have the honor to inform you that I have lately visited some of the principal forests and plantations in British Burmah.

2. I left Gopalpore on the 13th of January, and landed at Rangoon on the 17th of the same month; on the morning of the 18th, Mr. Carter of the Forest Department, accompanied me up to Okhan (by rail), about sixty miles from Rangoon, from which place I visited the Mayagee teak plantations situate about ten miles off in the forest; these are the principal teak plantations in Burmah; thence I ascended into the natural teak forests on the Pegu Yoma, and returned to Rangoon on the evening of the 21st. At daylight on the 22nd, I started by steamer for Moulmein and landed there that evening. Major Seaton, the Conservator of Tennasserim, had kindly planned a tour for me in which I could best see in a short space of time all the different classes of forest. He was absent at Meerawaddy in his principal teak forests on the banks of the Thoungyeen, where I was to join him. On the 24th, I started by boats which delivered me and my camp at Kyleu near Megaloon on the Houndraw river on the 26th. The same evening I marched to Kankerik, where I was met by elephants which Major Seaton had kindly hired for my camp, and traversing the magnificent evergreen forests of the Donat range I crossed those mountains and joined Major Seaton at Meerawaddy on the Siam frontier on the evening of the 28th; thence we visited together some of the principal teak forests of Tenasserim and the pine forests (*Pinus merkusu*); and travelling south-east up the banks of the Thoungyeen until we reached the Meglar river, we ascended this stream trending west-south-west till we arrived at the foot of the Mooleyit, one of the highest mountains in Tenasserim. This we ascended from the eastern side, and descended by the west face, which took us six days; although we only halted one day at the top, which I found to be as near as possible 6,500 feet above the sea; and I had the advantage of seeing both evergreen and deciduous forest and bamboo tracts at different elevations. On the morning of the 11th February, I left Major Seaton at Assoon on the banks of the Houndraw, one long march from the foot of the Mooleyit mountain, as he had to return to the Thoungyeen forests, and by one very long march I reached my boats at Kyaen and arrived at Moulmein on the morning of the 14th idem. At daylight on the 15th, I left for Rangoon, from which port I sailed for Madras on the 19th, arriving there on the 25th.

3. The greater portion of Burmah even all the plains is still one vast forest, except where cleared for rice cultivation (which is almost entirely only rain fed). The country is now what India must have been many centuries ago; still a Forest Department has been considered necessary, and large tracts of teak and other valuable forests are being formed into strict reserves. The country is chiefly characteristic for its number of *Dipterocarpus* (wood-oil or sâl trees) of the genera *Dipterocarpus shorea* and *hopea*, gigantic straight growing trees often with very valuable timber, which form vast tracts of forest. Of all these numerous species only one is also common to southern India, *viz.*, the *Dipterocarpus turbinatus*, and I am not even sure that this is specifically the same, and many might I think be introduced with great benefit into the western forests of this Presidency. The sâl of Burmah which is exported occasionally to Madras and elsewhere is quite distinct from that of our eastern forests, (Goomsur, &c.) It is the produce of *Shorea obtusa* and of *Shorea* (or *Pentacome*) *Siamensis*, whereas our sâl is *Shorea robusta* which does not appear to grow in Burmah at all. This is an important question, and as I have brought over specimens of both these Burmah sâls, I shall ask the Gun Carriage Department (who chiefly use this timber) to compare and report on the three different species.

4. A great number of the Burmese trees are identical with south Indian ones: but about one in three were new to me. I was in the country at a time generally a little too early for the flowers and too late for the seed, but I was able to collect a few seeds that will be of use in our plantations and gardens, and Major Seaton has kindly promised to send me seeds of many trees and bamboos that I was able to point out to him (he knew the Burmese or Karen names,) and which will be of great value to us.

5. Our two most valuable bamboos in south India, *Bambusa arundinacea* and *Dendrocalamus strictus*, are both very common all over Burmah, the former on river banks, the latter on dry hill slopes; but there are very many other bamboos quite unknown to us. Three of these, the *Dendrocalamus brandisu* (Wabo of the Burmese), *Dendrocalamus longispathus* (Wa-ye of the Burmese), and white and green striped species growing in the Tenasserim Forests and known as "Tavsindein," but apparently undescribed botanically, might be introduced with very great advantage to this presidency. Major Seaton has very kindly promised to send me seed of all these; the two latter I procured in flower.

6. The teak forests in Tenasserim are always in small patches here and there, interspersed with tracts of quite a different character. Most of the larger trees have been cut out, but there is splendid young growth. However, I saw nothing to equal our Anamalai teak forests. Of late most of the teak exported from Moulmein has come from the Shan States of Siam. On the Rangoon and Pegu side there has been no feeling of late in the Government forests; all the teak for exports coming from Upper Burmah.

7. I was much disappointed in being able to learn nothing as to what the supply of this timber is likely to be in future, and whether the price is likely, to increase from the necessity of tapping forests distant from river communication. Most of the teak supply is, and for many years probably will be, from forests beyond the control of Government, and none of the Forest Officers I met could give me any information on the subject. It is a question of considerable importance that should receive attention.

8. I was greatly disappointed with the teak plantations I saw at Mayagee; they cannot be mentioned in the same category with our Nelambur teak plantations. They only go back as far as 1872; but some two hundred acres were planted in that year, and about the same every year subsequently. In the first rains, after the forest is felled for planting, a terribly dense growth of two gigantic grasses springs up, a very large species of *Saccharum*, 15 to 20 feet high, known to the Burmese by the name of Kyne, and the *Thysanolæna acarifera*, another grass almost as large. These seem quite to choke all other growth, and it is only here and there in small patches that the teak promises to make way against these grasses. It appears to be impossible to keep the growth of these grasses down, and it has been equally impossible to keep out fires which apparently have every year run through all the plantations utterly destroying large areas.

9. In this Presidency I am glad to say we are not pestered with either of these grasses. Taking the very best portions of the three older plantations (a very limited area) the growth is as follows:—

1872	...	Average height	22
		„ girth	10
		Greatest	15
1873	...	Average height	18
		„ girth	8
		Greatest	12
1874	...	Average height	10
		„ girth	6

which contrasts very unfavorably with Nellambur. The country is besides terribly feverish and knocks up all the establishment, so that these plantations will, I anticipate, be abandoned before long, and I cannot see that they are required when there are large tracts of most promising natural teak on the hills close by in which if the same amount were spent on fire-tracing, &c., the results would be most favorable. The two grasses above-mentioned do not appear until the forest is felled and burnt, so that they are absent from the natural teak forest. The system of planting pursued here is that of sowing one or two teak seeds in each pit, not planting out from nursery beds as at Nellambur. This sowing plan has never answered with us, as owing to rats and other vermin, insects and grubs, the growth has always been most irregular, and it has been absolutely necessary to supplement to a large extent subsequently by transplanting from nursery beds.

10. Elephants are so abundant in Burmah, that Forest Officers have a fine supply of this labor, and I was surprised to find that these animals even when in full work are scarcely ever fed beyond the grazing they obtain for themselves. In rare instances one measure of paddy is given each evening to each animal. Our elephants are much pampered I am afraid, and it has always been considered necessary to give six or seven large measures of rice daily to each animal, besides cocoanuts, oil, ghee, &c., making the cost of their keep exceedingly heavy; yet almost all our elephants come from Burmah. This question must receive the attention of all our Forest Officers using these animals, and though it might be injudicious to at once stop their rice, I think more economy can be gradually introduced, and I have always felt certain that in the absence of very strict supervision as to feeding, that a great deal of the grain or the amount paid for it goes into the pockets of the *mahouts* or *fonjdars* I have myself detected glaring instances of this, when elephants have received no grain for many days, though it has been paid for.

11. I had the opportunity of collecting a great many orchids; the bulk of these I sent to the Lall Bagh Gardens at Bangalore, as most likely to succeed there. Most of the remainder I have given to the Ootacamund Government Gardens.

The Government have perused with interest the Conservator's account of his recent tour in Burmah.—*Madras Athenæum.*

THE public roads of the late kingdom (now province) of Hanover are nearly all planted with apple trees. The guardians of the roads are instructed, and take interest in their trees. They guard the fruit till ripe, when the trees are sold singly by public auction, and the proprietor has to guard them and take the fruit down without damaging the trees. The money goes to the direction (office) of the public road. These trees give shelter, ornament, and fruits. To plant trees along railways has not been found practicable, by reason of the telegraphic wires, &c. In the kingdom of Wurtemburg (capital, Stuttgardt) much has been done in this respect, and proposals have been made to plant the side of the railways, but I do not know with what result.—ALFRED VON SEEFELD, in *Dietetic Reformer.*

THE prophecy of a time when California may become as arid as the sands of Bikanir, may well startle a generation accustomed to regard that fair province as the future garden of the world. Yet that contingency is not only not improbable, supposing the agencies at work are permitted to continue, but the steps in the process may be exactly anticipated in detail. Forest denudation, of a character as reckless as any ever known in India or out of it, has been at work there through a long series of years. Even now vast mountainous tracts over which the forests once waved, are growing bare; and in course of time, nothing will be seen but barren rock. Without the resistance offered by the tree roots, and their soil, no rain-stores can be preserved in the uplands: and, finally, there must ensue an alternation between seasons of short destructive rains, and seasons of even more destructive drought. Precisely the same thing has happened in India, and is happening on the slopes of the Rhine, the Rhone, and the Southern Alps, even now.

In a long article upon the management of forests, the *Constitutionnel* adverts in complimentary terms to a report recently presented to the French Society of Agriculture, and containing a sort of *résumé* of the timber supply now existing in various parts of the world. According to this statement, which is drawn up by M. Barble after several years of careful study, the state of the forests not only in Europe but in all countries is unsatisfactory in the extreme. One universal complaint is heard on all hands—that the stock is being rapidly exhausted, and that there is no economy or common prudence in the way of administering the public and private forests. The Swedish Government is beginning to be seriously alarmed at the export of timber from its territory, which is no longer limited to Europe, but has extended to such distant regions as Brazil, Australia, and the Cape of Good Hope. Denmark has discovered that two-thirds of its forests are lost; and Russia, having exhausted the forests in the neighbourhood of its large towns, is now compelled to go to a vast expense in transporting its supplies of wood from the interior. As for Finland, which was once so rich in pines, it is already beginning to be absolutely denuded, and that not so much in consequence of an actual exportation of timber as of the habit of setting fire to whole masses of trees in order to clear the ground for agricultural purposes. Fire is also a great destroyer of timber in Algeria and other parts of Africa, but in this case not artificial but accidental conflagrations must be held to blame. In Austria the young plants are destroyed by the cattle, whilst the old ones are cut down remorselessly; and in most parts of America the sole idea of a forest is that of an inexhaustible mine of wealth. Germany is without doubt, the country where most common sense has been applied to the use and preservation of the forests, and the French *savant* calls for a more severe application of forest laws to France, where he maintains that with proper management there might be plenty of timber left for the public use.

MINERALOGY.

An American paper publishes a summary of a very interesting lecture delivered at Washington recently by Mr. P. W. Morris, the Superintendent of the Yellow-stone National Park, on some of the natural curiosities of the region over which he presides and is engaged in exploring. Among these may be mentioned as the most novel, a mountain of obsidian or volcanic glass, and a road made from this material. Near the foot of Beaver Lake, the explorers discovered this mountain of glass, which there rises in basalt-like columns and countless huge masses, many hundreds of feet high, from a hissing hot spring forming the margin of the lake, thus forming a barrier where it was very desirable that a wagon road should be, as the glass barricade sloped for some 300 feet high at an angle of 45° to the lake, and its glistening surface was therefore impassable, there being neither Indian nor game track over it. To make the road, huge fires were made against the glass to thoroughly heat and expand it, and then by dashing cold water from the lake against the heated glass suddenly cools the latter, causing large fragments to break from the mass, which were afterwards broken up by sledges and picks, but not without severe lacerations of the hands and faces of the party, into smaller fragments, with which a wagon road one-quarter of a mile long was constructed, about midway along the slope, thus making, it is believed, the only road of native glass upon the American continent. On reaching the Grand Canon of the Gibbon river the explorers found the eastern palisade, for about two miles in length, to consist of vertical pillars, hundreds of feet high, of glistening black, yellow, mottled, or banded obsidian or volcanic glass.

This obsidian it seems has been, and is still used by the Indians for making arrow heads and other weapons and tools, and the mountain has formed a vast quarry for the material of such instruments or weapons of a quality and quantity unequalled elsewhere.

INDIAN IRON.

It is sincerely to be hoped that the Government of Bengal will be able to render some such substantial aid to the "Bengal Iron Company" as will put its prosperity, as a commercial undertaking, beyond the possibility of doubt. The present position of the iron trade of the country is really a discredit to the administration. Iron ores, of various degrees of excellence, are found, it has been known, for centuries, in several parts of the country. There are large deposits in Chanda, in Salem, in Kumaon, in Bundelkund, the Nurbudda Valley and south-east Berar. The supply is stated by Mr. Blandford to be, in many instances, inexhaustible. Near Salem there are immense beds, 50 to 100 feet thick, the outcrop of which may be traced for miles. One of them forms the ridge of a hill 1,500 feet high and 4 miles long; in another place, near Salem, there are 5 bands of magnetic iron, from 20 to 50 feet thick, which run all round a hill 4 miles long. At Lohara, near Chanda, there is a hill 2 miles long and half a mile broad, which, Mr. Blandford believes to consist entirely of almost pure iron ore, yielding to assay 70 per cent. of metallic iron.

Every year iron is more wanted in India and yet, notwithstanding this splendid natural supply, the manufacture of iron is at a standstill, or rather it is *declining*, as the rough native methods of smelting die out from the increasing price of wood. As long ago as 1825, Mr. Heath, a Madras civilian, took the subject up, and established works at Porto Novo. These never succeeded and were finally abandoned in 1860. Another attempt was made at Raneegunge and another at Jubbulpore, but with no satisfactory result. Subsequently Mr. Mitander, a Swedish metallurgist, started some works under Government in the Valley of the Nerbudda. Those probably might have succeeded, but that their patron, Sir Henry Keatinge was removed, his successor "knew not Joseph" and did not care about iron, and the Government, in one of those miserable fits of retrenchment, of which we are just now feeling the results, closed the works, dismissed Mr. Mitander and determined to throw no more good money after the £75,000 which it had already embarked in the undertaking. Another attempt was made a few years ago at Madras, with but little of the caution or knowledge necessary to success, a piece of rashness for which Messrs. Arbuthnot, the promoters of the Company, and large shareholders in it, have had to pay heavily. The Bengal Iron Company will not, we earnestly hope, contribute to the list of unsuccessful experiments. One incident in its history illustrates the sort of defect in the law, which so often stands in the way of practical improvement, and which the Legislative Department, if it could only get its head out of the clouds, might do such incalculable good in removing.—*Civil and Military Gazette.*

GWALIOR IRON.

(To the Editor of the "Delhi Gazette.")

Sir,—Of Indian iron, generally, the *Civil and Military Gazette* of 6th June, contains these remarks: "Iron, as we pointed out the other day, still stands in need of those expensive investigations and experiments which Government alone is likely to conduct to a successful issue. The Government ought assuredly to do all in its power to encourage this branch of industry, for, till the home manufacture of iron is established, all other manufactures labor under a grievous disadvantage. Suppose, for instance, that the cylinder cover of an engine is driven out, a mill may have to be closed for months while a new cover is being obtained from England. In fact, till iron and coal are satisfactorily established, the future of all other mechanical industries must remain undecided."

2. In the publication of these very opportune suggestions I find occasion for contributing to your columns some valuable information respecting the iron of Gwalior, communicated to me, in 1876, by an intelligent English blacksmith, whose testimony, you will perceive, is professedly based on personal knowledge. I myself implicitly believe my informant's statement; and I take for granted the practicability of honest political action, on the part of Government, for rendering available, in the interests of the Empire at large, the heretofore undeveloped material resources of an eminently friendly Native State.

3. Impelled by a desire to acquire some knowledge of the minerals of this country and of native modes of dealing with them, my informant visited Gwalior in 1874. His observations on the spot satisfied him that the Gwalior Territory contains what is better for utility than a gold mine; for he there found the country between Lushkur and Seepree, 60 miles or more in extent, to be one unbroken bed of brown hematite, the richest ore in the world, yielding, even to rude native operators, so much as 75 per cent. of iron. What the maximum and average depth of this bed may be, had not then been discovered; but the natives found their material within a foot of the surface, and a depth of 12 feet was the lowest that had been reached.

4. The native mode of working the ore was of course primitive; yet it fully answered, as a preliminary process, for providing really excellent iron, in a crude state, most admirably adapted for all the ultimate purposes of a wrought-iron factory conducted on European principles, and with suitable machinery. The fuel employed by the natives was charcoal; from 20 to 30 seers of charcoal,—worked iron was the product of each heat; the final operation on the mass with sledge hammers served no other end than that of bringing the metal into the crude condition; and at this point the application of European science and invention was needed to convert the charcoal-worked iron of Gwalior into the best iron in the world, for which a readier and more profitable market would be found all over India than for any other iron.

5. My informant had fully considered the comparative merits of *cast* iron and *wrought* iron, from a remunerative point of view. In the India of the present, wherein the construction of machinery to any considerable extent is not attempted, it would be quite a mistake to expend much effort and money in erecting furnaces for the manufacture of *pig* iron, without at the same time providing *puddling*, furnaces *for converting the pigs into malleable iron.* Extensive demand for any other than *malleable* iron necessarily belongs to the India of the future; and my informant therefore deemed it a cardinal point to assign the *cast* iron business a very subordinate place in his scheme, and to plead very earnestly for the concentration of energy and capital primarily on the *immediate* production of *wrought* iron from the excellent crude material of Gwalior, that had accidentally acquired the important good quality of a carbonic impregnation in the rude charcoal furnace of the native operator. There is no town, or village, or hamlet of India, that has not smith, or smiths, incessantly at work *on malleable iron*; and wherever the iron of Gwalior is known and obtainable, it is decidedly preferred to any other.

6. I desire to state here, very explicitly, that what my informant contemplated was altogether distinct from the making of pig iron and its subsequent conversion (by the puddling process) into malleable iron. His scheme involved, in *fact*, a vast and revolutionary improvement on this round-about process for the production of malleable iron; a process which, though indispensable with other and *inferior* descriptions of the metal, or with *ore*, is *absolutely unnecessary with the Gwalior material*. This material *is not ore*; it is *most excellent, ready-made, crude iron*, taken from the rude charcoal furnaces of the native operators of Gwalior, and possessing the desideratum of a carbonic impregnation. This most excellent crude iron of Gwalior, in the state in which it is received from that country, is quite ready for *immediate* conversion into finished BAR and ROD, and my informant's proposed process with it was three-fold, simple, and expeditious (1) he would heat it in his furnace; (2) he would smite it, when hot with the steam hammers for removal of impurities; (3) he would subject it to the final action of the rolling mill. The *super-excellent quality* of the Gwalior iron can be thus proved; a rod of it, *cold*, may be drawn out by simple hammering *without splitting*; this cannot be done with English iron.

7. My informant believed his conception to be that of a new and most important industry for India, which only needed due recognition and substantial support to become a source of unexampled perennial profit. I held the same opinion then, and hold it now.

8. Three years ago the Maharajah Scindia's attitude in regard to the ore his territory was understood to be that he would work it himself. It is said that at one time, certainly more than a dozen years ago from the present time, he consented to allow an outsider to develop the mineral wealth of his territory, and actually advanced a lakh of rupees by way of commencement; but there the matter ended, and Scindia lost his money irrevocably. From that time, it would appear, the defrauded chief has resolutely turned a deaf ear to the overtures of every successive adventurous "charmer." My informant was credibly informed, in 1875, that his Highness then intended to turn his attention to the iron business after all the expense and hubbub of the Prince of Wales' expected visit had ceased.

Lord George Hamilton, in his speech on the Indian Budget, delivered three years ago, said "Again, the greatly increased demand for stores of all kinds, especially iron, *which could not at present be manufactured in India*, had caused an increase under that head of from £900,000 in 1856 to between two and three millions in 1876-77." The italics are mine; and the question I would ask is *Why cannot* iron be manufactured in India, and of *a better quality* than that procured from England? The professional opinion embodied in this letter is, that it most certainly *can*.

I could not, as you know, have sent this letter to the *Civil and Military Gazette* without disloyalty to your paper. I hope the Lahore journalist will very kindly accept this explanation and find room for me amongst his extracts.

As my name carries no weight, I do not offer it for publication.

SCRIBE.

12th June 1879.

GWALIOR IRON.*

AN able letter which appeared in our correspondence columns yesterday, drew attention to the valuable qualities of Gwalior iron. Every one who has had occasion to employ that material, has been struck with its excellence, and engineers on the E. I. Railway, pronounced it to be without exception the very finest they had ever come across. No doubt the fact of its being smelted with charcoal has a great deal to do with its excellence, just as Swedish iron which is also smelted with charcoal, is without comparison superior to any that is manufactured otherwise. This superiority can of course only exist in countries that are well supplied with timber fuel, and we fear that the Gwalior territory has already been too far denuded of trees to admit of further drafts on its resources in that line.

Still, the statement put forward in our correspondent's letter and which we know to be derived from an authentic source, deserve a careful examination; and we would press upon his Highness the Maharajah of Gwalior not to lose the opportunity of signalising his reign by the development of the metallic resources of his dominions. More real wealth, as our correspondent has truly observed, is to be derived from iron works than from a gold mine; and if the Gwalior Territory were to take the lead in creating the former, it would establish for itself a position that every other Native State, and even the Government of India itself, might envy. Scindiah, we know, has had many calls on his purse lately. The Prince of Wales' visit, the Imperial Assemblage at Delhi, and the terrible famine of 1877, have sadly strained his resources; but with a wealthy State like Gwalior, under the rule of a Prince who personally superintends every branch of the administration, such losses are easily repaired. At any rate there is no way more ready or effectual to repair them, than the establishment of works which will give employment to thousands w[illegible] impoverishing any, and which will make one of the necessaries of [illegible] cheap and easily obtainable by all the natives of Gwalior and the surrounding States.

We are not counselling his Highness to rush at once into a vast outlay on iron works. We are simply expressing an opinion which we are sure every journalist and man of business thoughout India will endorse, that his own interests demand that the statements contained in our correspondent's letter should be thoroughly sifted by the highest professional talent that England can supply. Thanks to railways and ocean steamers, India is not the remote land from an English point of view that it used to be, and we are sure that if his Highness were only to express a wish (backed of course by the funds necessary to meet the expenses of the way) to have the metallic resources of his territories examined and reported on, by professional assayers and mining engineers, dozens would volunteer their services from England in the hopes that business might result from the investigation. An advertisement in any of the Home papers, setting forth the facts of the case and calling for the assistance of such persons, would draw forth applicants, from whom it would be easy for the Maharajah, with the friendly aid of the authorities at the India Office, to select a few whose opinions and experience could be thoroughly relied upon.

In making the above suggestion we do not wish to prejudice the interests of the gentleman from whom our correspondent derived his information, and who, as far as we are aware, has been the first to draw prominent attention to the metallic wealth of the Gwalior State. Strict justice demands that his interests should be carefully attended to, and we do not doubt that should the Gwalior iron works ever become an accomplished fact, Maharajah Scindiah will not forget the man to whom he first owed the suggestion of their existence. But we do say that before proceeding further, a careful enquiry conducted by a jury of impartial examiners, is before all things requisite. Great mistakes have been made before now by not attending to this precaution, as the unfortunate Kumaon Iron-works abundantly prove, but there is no reason why, with the experience now gained, such errors should not be avoided in future.

There is one fact in the history of the iron-trade which seems to be established beyond dispute, *viz.*, that England is ceasing to be the great centre of manufacture that it was in former years. A note in our first page to-day, referring to the death of Mr. Crawshay the "Iron King of Wales," says that gentleman finally closed his works owing to a dispute with his workmen about wages.

The full import of that sentence can hardly be realised by those who are unaware of the prodigious dimensions to which the South Wales iron manufacture had grown, but we believe that we are within the truth in saying that 14,000 workmen and an expenditure of £9,000 *per week* in wages, represented the extent and cost of Mr. Crawshay's establishment. In fact he had nearly four times as many men in his service as there are European soldiers in the whole of the States under the Central India Agency!

When will the Gwalior State be able to boast that its army of iron-workers is equally as great as that of the private gentleman whose death has lately taken place?—*Delhi Gazette*; *13th June* 1879.

* See above.

A GEOLOGICAL TRIP, AND ITS INCIDENTS FROM COLOMBO TO BELIHULOYA, VIA RATNAPURA.

[BY A. C. DIXON, SCIENCE MASTER IN THE COLOMBO ACADEMY; *Bachelor of Science, with honours, of the London University, &c., &c., &c.*]

MANY attempts have been made to search into the geology of this island. Several writers, however, have put it in the background as offering no great reward to the student of nature, but although it may not be of much interest to one accustomed to search for fossils, yet it offers a great field of study to the student of rocks and their formation.

This land upon which we dwell, upon the soil of which so many Europeans have for a considerable time cast their lot, must have some place in the earth's history, and no doubt that although some are apt to describe the bulk as granite or primitive rock, others, more correctly as gneiss, yet this metamorphic rock of so many varieties may not even be of such distant age as is imagined. True there are appearances in its structure that point to the Laurentian age, equivalent to the beds occurring in the basin of the St. Laurence, in which formation, although highly metamorphosed, we find the first dawn of life on the earth—the oldest known fossil, the *Eozoon Canadense.*

Metamorphic rocks are of various ages; they may belong to the primary, secondary or tertiary periods, and there are some features worthy of notice here that seem to point to an age much younger than the Laurentian. If such should be the case then we might even hope to find that most valuable of all minerals (coal); that mineral which for a long time was pronounced absent in India on account of the occurrence of rock not much unlike our prevalent one.

Another point worthy of attention is the vast disintegrating power busy at work. Those of us who had from northern climes known the vast power of frost in the pulling down of rock masses, but here it appears that we have even a greater force in the case of moisture and heat. This disintegration has gone on to a vast depth, as is evident by the great masses we come across in various parts of the island; a notable example being the Halpe slip.

Travelling along on the high-road to Haldummulla, by coach or otherwise, may seem to many a succession of monotony, but to the student of nature, whatever branch he may delight in, he will find much to entertain. For a considerable distance from Colombo we have a tolerably flat district with here and there an undulation; here and there the cabook, the disintegrated gneiss standing out prominently. Still further on, we meet with rounded hills apparently detached from the more distant, yet having a basal connection, and as we progress we are soon able to make out the great culminating points of the elevated regions. Standing on the top of any of these, we then see the general outline of the whole with its wonderful valleys, and obtain a fair idea of the river systems. Can we look on such a scene as this without wondering how long these running waters have been occupied in carving out the land into the fashion in which we now see it, and how the aërial agencies have assisted and left such a configuration, often thinking why the stream should have taken such circuitous courses when others might have sufficed.

Examining the varied forms of these rocks, we find many interesting products; two perhaps of great interest to agriculture, that branch of science of which so much ignorance is at present displayed, which alone is developing and will still more develop Ceylon.

The two products are felspar and limestone; we find felspar in many forms, the most common being of the potash variety and this occurs very much disintegrated in great masses.

The *potash*, and alumnia, its companion metal are in combination with an acid called *silicic*. The affinity of silicie for these is so great that hitherto all efforts to find one of greater affinity for them at ordinary temperature has failed. Yet slowly the mysterious working of nature unlocks it for the use of plant life. The other product, limestone, the *hunugal* of the Sinhalese, is much more abundant than is generally thought. It occurs soon after leaving Awisawella at the village Hunugewatta, the name of which indicates its occurrence, or that the caste of the *Hunawas*, the lime burners, dwell there. Many of the names of these villages are apt to be passed through the mind in silence, but on enquiring into the origin of a word we find much in a name; such derivation is often difficult to trace and not known at all to the present dwellers, which would seem to point to the fact that many of these received their names from a wiser generation than the present one, and this is still more evident if we look at the ancient temples situated on this route, for where should we be able to find any amongst the present race, capable of executing such work. Limestone is found on this road every now and again in considerable quantity, with a considerable break however, at Ratnapura.

Its occurrence is crystalline, the size of the crystals varying very much as well as the *hardness*, but all are readily scratched with a knife. Felspar may be scratched with difficulty and quartz crystals not at all. As to purity, in some cases we find considerable quantities of siliceous grains about the size of a pin's head, and phlogopite, a species of mica in six-sided prisms, as well as other matters in small quantity.

Some of these limestones contain a great quantity of carbonate of magnesia and are then called dolomite (after the French geologist, Dolomieu). We have considerable masses of such at *Hunuwala, Pallankanda*, and *Ilpa*, all between Pelmadulla and Balangoda, at Belihuloya, we have a good crystalline, limestone containing but little magnesia. The natives, however, do not appear to use these limestones for making *chunam*, but prefer to calcine the shells, which are abundant in the streams. Formerly, however, they must have used lime for some purpose, as remains of lime-kilns exist, which have evidently been used. With careful examination, probably several of these masses of lime-stone would be found to be joined as one bed or vein.

At Ratnapura there is much to interest the geologist. The flat patches, broken up to a great extent by gem pits from which no doubt many valuable gems have been taken, are especially noteworthy. The crystals, whether occurring as a whole, or water worn, in their various shades, hardness, and value, are very interesting. Let us think how they came there. They were formerly components of the sesame gneissic rocks, the softer parts of which have been carried away and these harder gravelly masses were left in the beds of the ancient streams. But gems of still greater value to the *geologist* are to be found here. In this district as well as in several others we have the river gravels of former ages; it may be of pliocene or post-pliocene times. In these gravels have been found the fossil bones of the elephant, namely. two metatarsal bones. No doubt many other bones have been dug up in a similar manner and thrown away by those who knew not what they were. In this particular instance the bones were much prized; money would not secure them. They were required for medicinal use. It is said the tide of civilization is westward; let us hope that soon its circle will have been completed, and that such strange superstitions as are so prevalent may soon be dissipated.

Much has been said respecting a geological map. As new deposits or rocks of economic value are made evident, then we may be in a fair way to ask for such for the whole of Ceylon. Much might be done by planters and others whose lot it is to be scattered over various parts of the Island, if, when they find a fresh rock or deposit, a cave or its contents, they seek to know the why and wherefore of its occurrence.

Another product of value which occurs is good brick-earth, well adapted for brick or tile making. Among the minor products of the rocks we have in the Balangoda district, the occurrence of the rare and valuable metal, Molybdenum, so useful in analytical researches. In the same district we have also the occurrence of garners, not rubies, as related by Dr. Gygax, of the lime alumina variety, and around Ratnapura the valuable ore, black oxide of manganese. Perhaps when the railway traverses this district we may look forward to the dense and impenetrable jungles giving way to trees, shrubs, or plants of value. It really seems a pity to see the soil derived from this gneiss spending its energy in such dense masses of undergrowth and to see the *loafer*, however pretty they may appear, preying upon and hampering the good jungle trees which are of value. A little more knowledge of forestry and its application would be of great service.—*Ceylon Observer.*

A COMPANY has recently been started in Glasgow called the "Indian Gold Mines Company," with a preliminary capital of £50,000, for the purpose of working the land held by the Wynaad Prospecting Company, the Prince of Wales' Gold Prospecting Company, and by some private parties. The Directorate appears to be a good one, and includes the names of Lord Claud John Hamilton, M. P.; the Right Hon'ble Sir James Fergusson, Bart; Sir William J.W. Cunningham, Bart,; Sir James Watson; Mr. Andrew R. Scoble, Q. C. (late Advocate-General of Bombay); and Mr. Samuel L. Howard (the well-known Quinologist). We understand that the whole of the preliminary capital of £50,000 has been raised, and that £25,000 of it has already been remitted to this country, with a view to commencing operations immediately. Mr. Howard, one of the Directors, and member of a leading firm of mining Engineers, are now in Bombay, and are shortly proceeding to Wynaad. Messrs. Barclay and Morgan, of Bombay, have been appointed Solicitors of the Company, and are making the necessary arrrangements for the transfer of the properties.

WE understand that a prospectus has just been issued in this city, under the auspices of some experienced mining men and planters of Wynaad in view of prospecting the gold reefs of that district.

While wishing the enterprising projectors all success, we take occasion to refer such of our readers as may feel interested, to the June number of the *Indian Agriculturist.* Mr. A. Roscoe, one of the projectors, is at present in Calcutta with a view of starting his scheme.

GOLD IN SUMATRA.

SUMATRA is attracting practical attention as being the gold island of antiquity. Mr. Verbeek, an engineer, for years successively has been making investigations in the Padang Highlands at Supayang, into the possibility of finding gold in large quantities in river beds buried there under volcanic matter. These investigations have resulted as satisfactorily as possible, and the said engineer has secured the co-operation of one of the wealthiest inhabitants of Netherlands, India, in forming a company to work a mining concession granted to him for five years. The capital of this company is fixed at 400,000 guilders, divided into shares of 250 guilders each. The prospectus which appeared yesterday excels in clearness and simplicity, and it appears from the articles of association that people have to do here with the application of capital to mining operations for the gold ore, which, as Mr. Verbeek declares, is to be found in abundance. Should this trial succeed, the company have a splendid future before them. Should people inquire whether we believe in a good result, we answer, roundly, yes. And that, too, because we consider Mr. Verbeek a very scientific, and, at the same time, a very discreet and calm person, who inspires us with the utmost confidence in the solidity of his observations. Within two years the results obtained by him are to be made known. We heartily wish complete success to the promoters and shareholders of the company.—*Batavia Handelsblad,* 3rd May.

GOLD MINING IN DECEMBER LAST.

AFTER repeated requests the Madras Government have at last issued Mr. Brough Smyth's report of his discoveries in December last justly held by those who toured with him, to be the most important of his investigations. In the early part of December some progress was made with the compilation of the maps of the district. From the 10th to the 20th December (says Mr. Brough Smyth) I was engaged in examining the country between Devalah and Villirymulla. At Parcherry Hill about two miles and-a-half east from Charambadi, there are native workings which, both as regards their extent and the manner in which the mining operations have been conducted, are of unusual interest. The quartz has been obtained from large and small excavations, from adits, and from shafts, and the manner in which the broken quartz has been disposed of, would almost suggest that the works had been managed by some one who had the miners under strict control. The quartz vein contains iron pyrites, lemonite, hæmatite, and free sulphur. Several dishes of broken quartz were washed and minute specks of gold were seen, and subsequently fine gold was got by amalgamation. All the tests have not yet been completed, but I am satisfied that this is a reef that should be carefully and thoroughly prospected. Notes were made respecting all the outcrops of quartz observed between Parcherry Hill and Vellirymulla. On the Naiken Shola and Little Windsor Estates sixteen outcrops of quartz were examined, and some of these can be traced north-westerly into Cheppah Thodah. Gold—some of it rather heavy—was got in a swamp at Chaladi, near which there are quartz veins; and between Charambadi and Moopenard eighteen separate outcrops were seen. On the Moopenard Estate and on the estates at and near Vellirymulla there are numerous reefs. Gold was obtained by washing the earth in several places; and in my humble opinion there is a reasonable prospect that auriferous quartz, likely to yield at a rate that would remunerate the miner, will be discovered in the district. Pieces of quartz containing gold were found lying on the edge of a track at Vellirymulla; but the gentleman who was so good as to conduct me to the spot, had not at that time ascertained from what reef they had been taken. It may perhaps be the reef referred to in paragraph 18 of my report of the 5th November. The gentleman who gave me the information contained in that paragraph was, I was told, absent from the district. Many planters are now giving attention to the quartz reefs on their estates; some of them are incurring expense in opening the veins, and they are sending specimens to me for examination. This kind of prospecting, though necessarily falling far short of that which has resulted in the discovery of rich veins in Australia and California, cannot fail to be of benefit. During my journey I was greatly indebted for information and assistance to Captain Hardy Cox, Mr. W. Mackinlay, Mr. J. H. Thomson, Mr. C. Watson, and other gentlemen who have estates in the district.

PETROLEUM ENTERPRISE.

We find from last mail's Indian papers that Mr. Willoughby Savage has launched forth his project for an Arakan Petroleum Company; and we have reasonable grounds for asserting that the proposal is likely to be received favourably by the speculating sections of the community of Bengal and Burma. The prospectus is extremely moderate in its requirements, and its expectations are based on tolerably reliable data. It deserves success, and will doubtless merit the encouragement and support of Government.

It is fortunate that the Company intends confining its operations to simply extracting the crude mineral oil. We have unfortunate evidences to show that in refining and distillation, local manufacturers cannot compete with foreign, either in cheapness or quality of production; and an undertaking for such a purpose would, therefore, under existing facts, only imply failure as an inevitable result of the force of circumstances.

The latest quotation in the Calcutta market of the finest variety of American kerosine is Rs. 7 per case of two five gallon (=four gallons imperial) tins. This, it should be noted, is the *retail* price, involving two or more profits, besides freight over, perhaps, ten thousand miles of a sea voyage, with insurance and other charges. We can sympathise with the struggling efforts for existence of the Rangoon Oil Distillery; but we could not recommend the example of its projectors being followed; in fact, other things being supposed equal, taking the resources of the country and the present outturn of earth-oil, there is no room, just now, for such another firm.

Our readers are of course aware that rock oil is obtained in various parts of the world; and the chief centres of production of late years have been Pennsylvania and Canada, both in North America. In Asia, the coast line of the Caspian Sea, and Assam and Burma are the localities known to us in which it abounds. In Europe it is a pretty well known fact that the city of Genoa is lighted by means of a naphtha spring at Amiano in the State of Parma; and even in England carbonaceous shale, yielding oil, is no novelty.

But in reverting to Mr. Savage's undertaking, it may be necessary to add that he is not the only individual or firm who has, during the past year or two, been prospecting for oil in Arakan. It is not long since a provincial journal offered some interesting results of the operations of the Bombay and Burma Trading Corporation in boring for oil in the same neighbourhood, which confirms, or rather greatly strengthens, the statement he (Mr. Savage) furnishes of the richness of this region in liquid bitumen.

In reports relative to the subject, we are surprised to find no reference to a point which cannot fail to be of interest to many devoted to such researches, affording room for inquiry and elucidation—*viz.*, the prevalence of earth-oil all along the Arakan hills and their northern continuation into Assam at corresponding points on both sides of the range wherever it has been sought. The instance of coincidence may possibly be only casual or accidental; but the similarity of occurrence, so far as observation goes, renders the general conclusion not altogether improbable—leaving the question, which has never been fully discussed, open for investigation.

We shall be excused for using the hackneyed phrase once again—"There is a great mineral future for Burma;" and in inaugurating a branch of mineral industry for which the capabilities of the country are peculiarly well adapted, Mr. Savage deserves well of the province. We wish that the success of other undertakings with which we are acquainted had been equally as well assured. However, the standing reproach of the great want of enterprise among Europeans in the East can be hardly said to apply with justice or force at the present period. We find joint-stock concerns springing up everywhere, started on all sides of India, and among them may be enumerated gold-mining, Portland cement, ice, soap, and a host of other Companies, of which though last—but we hope it will be none the backward for that—is the one intended to be the pioneer of "petroleum enterprise" in Arakan.—*Rangoon Times.*

The American oil wells do not now, we learn, yield the quantity they did. Very opportunely attention has been turned to Arakan. There is abundant reason for hoping that a fresh stimulus will be given to the commercial prospects of the district. Experts have given an opinion, that the area is large, wherein oil may be found in quantity and quality not to disappoint the most ambitious speculation and the most liberal preliminary outlay. The late proprietor of this paper had great faith in the project now set afloat; and though his own hopes of starting a Company were grievously disappointed, we know he was interested enough in Akyab and the district to rejoice in the new prospects opened to the province. Whatever the result may be, Mr. Savage ought to receive unstinted credit for pioneering the way, and with limited means, and under discouragement and difficulty for persevering to accomplish that which others may have deemed visionary, but which he himself shrewdly concluded was feasible and profitable.—*Arakan News.*

ARAKAN OIL.

We have before us the valuable opinions of a gentleman deputed by the Government of India to examine the mineral resources of Arakan. They are contained in a pamphlet comprising the reports of the Geological Survey by F. R. Mallet, Esq., F. G. S. The existence of large petroleum deposits in that part of British Burma was inferred from the fact that, over a large tract of country, the oil is found oozing from the surface; and the investigation of Mr. Mallet, together with the labours of Mr. Savage (in whose property the Company referred to proposes to start operations), have put it almost beyond a doubt that at some depth the oil would be found in very large quantities. Mr. Mallet, at page 193, says that—

"Petroleum-bearing rocks occur throughout the islands, and that the oil-bearing rocks of Pegu, which are within 70 miles of Ramri in a straight line, are believed by Mr. Theobald to be nummulitic; all the known oil localities being situated on nummulitic, or still younger strata. The coal also from the Ramri islands is quite of the nummulitic type."

The existence of mud volcanoes is also believed to be associated with large quantities of mineral oil. Minbain in the island of Ramri, where Mr. Savage has some 70 oil wells, is close to mud-volcanoes, or salses, and is said to resemble in position and geographical features the best oil localities of America. On the connection between mud-volcanoes and petroleum, Mr. Mallet writes—

"The sources of the mud in the mud-volcanoes are undoubtedly the gray shales which form such an important part of the rocks throughout the islands, and the mud ejected therefrom always contains more or less saline matter. It is well-known how frequently mineral oil and salt are associated. In India, they are found together in the oil-producing tracts of Burma, Assam, and the Punjab. That the Ramri rocks do contain saline matter, I found by examining the shales or clay from the oil-mills in Tsichyong, Setaung, and Minbain, which when lixiviated with water, all yielded soluble chlorides and sulphates in varying proportions."

The association of petroleum with mud-volcanoes is also found in Java and at Baku on the Caspian, where a single well has been known to have yielded 2,000 barrels a day. Mr. Mallet, however, is of opinion that the Arakan salses have no connection with the "muddy pools" of Assam, and that Arakan is an oil territory by itself, entirely separate from Assam or the wells of the King of Burma. Another point noticed by Mr. Mallet is the resemblance between the bubbles of gas emitted from the oil-wells to those of mud-volcanoes. And Mr. Savage states that on boring to a depth of 150 feet, the gas issues with the oil with such force that the sound of it can be distinctly heard from the surface. A similar phenomenon occurs in the American wells. On this subject Mr. Mallet writes:—

"Recollecting the great tension at which quantities of gas are often stored up in coal mines, and the force with which it escapes from the 'blowers' there, as well as from many bore-holes in the oil regions of America and elsewhere, it is not difficult to conceive that in some cases, gas mud-volcanoes may be caused, where the other necessary conditions are present, by the pressure of gas due merely to its continued slow generation from carbonaceous matter at the normal temperature of the strata at moderate depths—but, given, certain coal or lignite-bearing rocks producing oil and gas, if they are situated on a line of volcanic heat (although of low intensity insufficient to fuse, or materially to alter, the rocks accompany such carbonaceous matter) the tension of the gas and vapour may, doubtless, be increased, by the larger proportion of gas compared to that of oil, produced at the higher temperature, and by the increased tension due to a higher temperature, where gas is stored up in a fissure of given capacity. In this connexion the difference between the petroleum of the Irrawaddy Valley (in Burma) and of Ramri (in Arakan) may be noticed—the mud-volcanoes of the former region have been described by Dr. Oldham as 'very sluggish', and as never exhibiting the fiery paroxysms to which those in Ramri are subject. At the same time the oil is dark coloured, and as thick as treacle, or even solid at 60° F., being indeed often spoken of as 'Rangoon tar,' and contains parrafine to the extent, sometimes, of more than 10 per cent."

Mr. Mallet further observes that "the Ramri or the Arakan oils are associated with much gas, and are themselves sometimes as transparent and light coloured as brandy—they have a lower specific gravity than the above, and at 60 degrees are perfectly mobile—without venturing to assent that the above differences are due to a difference in the temperature at which the oils have been produced. It may be noticed that at Baku on the Caspian, where there are mud-volcanoes subject to fiery eruptions, similar to those of Arakan, the oil is, in part, of the same pale, transparent kind, and is accompanied by immense quantities of gas."

Thus far we have confined ourselves almost solely to the reports of Mr. Mallet. They are sufficient to show that there is a prospect of a profitable and very extensive industry. Some further information before us on the subject we shall reserve for a future notice.

The Planters' Gazette.

TEA.

THE TEA MARKET.

IN our *last issue*, we had a few words on the prospects of tea, and confined ourselves to the inflated values put upon certain properties, making it impossible to have a reasonable dividend declared, however good the yearly results might have been. In this, we propose looking to the markets that exist for tea, and how we should meet those markets. For all practical purposes the only market we have at this moment is London. Various articles seem to have a tendency to gravitate to certain markets, tea to London, cotton to *Liverpool*. Doubtless London is the best market for many articles; there are congregated a vast number of merchants and capitalists, which of itself makes it the most suitable place, besides it has long been looked upon by foreign buyers as *the* place to get supplies. There is no reason however, why Indian tea growers should not look around them for other markets. Australia, for instance; we think a strong effort should be made to secure Australia for a market. The consumption of tea there is large per head of population, and that is fast increasing, and this increase consists,—with the exception of a few Chinese—entirely of Europeans, and of that class of Europeans who will likely prove good tea consumers. We will, however, confine ourselves at this time to the London market. The consumption of tea is steadily increasing in Great Britain, the following table shows the quantities consumed there at the several dates.

	Total consumption. lbs.	Per head of population. lbs.	Duty.
1801	20,237,755	1·20	35%
1811	20,702,809	1·12	93%
1821	22,892,913	1·08	96%
1831	29 997,100	1·23	96%
1841	30,787,796	1·37	lbs. 2*s.* 2¼*d.*
1851	71,466,421	1·97	2*s.*
1861	77,949,464	2·69	1*s.* 5*d.*
1871	124,723,063	3·92	6*d.*
1877	140,483,744	4·50	6*d.*
1878	197,499,000	5 81	6*d.*

This table shews the expansive tendency in the way of Home consumption, and, so far as appearances go, there seems every reason to expect that this will go on increasingly for a very long period, and for this reason, the present consumption when compared with that of fifty years ago may seem large, but *per se* it is exceedingly small. For instance take it at 4·50 lbs. This only amounts to one ounce and 6 drams per week, and who shall say that there is not room for further extension here. But there is another point, a few years ago this consumption was entirely of China tea, now it consists to a large extent of Indian tea as well. Last year the total imports of tea into Great Britain were 204,000,000lbs, we quote round numbers—of which India provided 34 million lbs.—the percentages being China 83⅓ per cent. India 16⅔ per cent. This year, the imports promise to be about 220 million lbs. of which it is estimated India will provide 18 per cent., as the extensions which have been going on for the past 5 years will now be coming into bearing, and they will speedily affect the *Indian outturn*.

That the taste for Indian tea is spreading, may be assumed from the fact that the stocks at home have usually borne a steady ratio to the quantities retained for home consumption, until last year, when a leap in favor of Indian teas were made. The increase in deliveries for Home consumption in 1878 over 1877, was 11 millions lbs., 2½ millions being China, and 8¾ millions Indian. Let us therefore take heart; the taste for our teas is steadily increasing, and this increase will be helped by the attempts which are being made just now by the Chinese to imitate the strong rich flavor of Assam teas, by using powerful chemicals in the process of manufacture, this is their only hope, as the low *jât* of the common China plant will not produce the strong tea at present in demand, the Japanese more wise in their generation set about seeking after the same result in a more sensible way; they are importing and planting out Assam hybrid seed. So far then as the London Market is concerned, there is a great future before us. Now a word as to the class of tea which we should make; in a word the question may be answered "quality before quantity," that being admitted, there only remains the question of classification. At present Indian tea is classed as follows:—Orange Pekoe, Pekoe, Pekoe Souchong, Souchong, and Congou. We do not speak of the lower—or as we might almost call them—the waste products, as red leaf and dust, these are the accidents of manufacture, and should if possible be sold locally, they should never go home, as the prices realized there for them is so low, compared with the freight, insurance, charges and duty. We think an improvement might be made in the classification, to the great advantage of the producer, and also of the consumer, we would suggest, that only one class of tea should be sent to England. When tea is bulked on the factory, it would be better that the red leaf and dust be eliminated and *all* the rest packed as Pekoe Souchong. By this means we are convinced that a good all-round price would be obtained, better than the average of the several classes, the expense and trouble of classification would be avoided, more labour would therefore be available during the busiest season, and thereby a larger outturn would be obtained, larger breaks would be offered for sale at a time, and last though not least, there would be much less broken tea and dust, as these are to a large extent the results of the multitudinous classification that goes on. In a late circular from a London broker, dated 29th May, we find the averages of the various classes of teas to be as follows:—

	s.	*d.*		No. of quotations.
Pekoes	1	10	... ...	13
Pekoe Souchong	1	3¼	... ...	13
Congou	0	9¼	... ...	6

Now a general average of these gives 1*s.* 5*d.* per lb. and it is presumed that the lot would have realized that amount had they been *all* mixed, whereas we observe the Pekoe Souchong only brought 1*s.* 3¼*d.* This has been tried before, but never properly, as planters have never been able to resist the temptation to remove the finest of the Orange Pekoe, hence the result, so far as the price got for the gross bulk was concerned, was usually a failure, because it wanted that very quality it should have had to make up for the thinness of the Congou. We feel convinced that with all, the Pekoe tips retained, the result would be a Pekoe Souchong, that would realize a very fair all-round rate, higher, in fact than the average of the same teas if classified from Orange Pekoe to Congou.

Let us now look to other markets. America consumes tea largely but purchases mostly from Japan, why should we not be able to induce her to take from us. Then Australia, we have never we believe, attempted to open out relations there, the population is comparatively small, but is increasing fast, and the Australians take all their teas from China. This is not as it should be, we should send trial shipments, open out agencies, and use other means to spread a taste for our teas. Have we done anything at the Cape, and what are we doing in Canada? Now that we are soon to have a commercial treaty with Affghan, we should find an opening there for about three million pounds per annum of green tea. Then there is India herself, Europeans, Eurasians, and even natives are fast becoming tea-drinkers. In the official year 1877-8 there was imported into India the large quantity of 2,323,033lbs. of tea, this was doubtless principally from China, and why should this be? Why because we send our cheap teas to England. It would be better to encourage the consumption of these here, and send nothing but the finer qualities to London. There must be about 8 to 10 millions lbs. of these cheap teas made in India annually, and it would be more economical to have all sold here, then sent to London, as all classes of teas, of whatever quality bear the same freight and duty per lb.

IT is a pity that the consummation of the commercial part of the Affghan Treaty should have to be delayed so long. For six years the tea trade that used to exist between the tea gardens of the North-West and Cabul has been quite paralysed and now at the commencement, one may say, of the tea season, it would have been a good time to enable the [illegible]

merchants to resume operations. These merchants—usually Cashmerees—reside at Umritsur, and send their agents to the three neighbouring tea districts,—Kangra, Debra, and Kumaon. They make arrangements for the purchase of the entire crop of the gardens, which is made into green tea. During the season this tea is sent to Umritsur in large canvas bags, containing two hundred pounds each. At Umritsur the bags are opened and the tea usually re-fired and faced with certain chemicals—principally sulphate of copper and gypsum, with the object of giving it that silvery, glossy appearance so much liked by consumers of green teas. It is then packed in small bags of about 15lbs. to 20lbs. each for convenience of carriage, as it is usually forwarded through the Trans-Himalayan passes by means of sheep and goats, these hardy animals being found most suitable for the class of work and the nature of the road and climate. Now these merchants are anxiously waiting to be able to resume this traffic again, but the insecure condition of the road from our frontier to Cabul has effectually closed the trade, and this has led to great loss to the planters interested, because of their class of tea being of the lowest *jât* of China variety. *Thea Sinensis* is ill adapted for making the strong, pungent black teas now wanted in London, and they are in consequence heavy losers by having to make black tea. If the treaty is to be good for anything, no time should be lost in carrying into effect the commercial part of it. The quantity of tea annually made in these three districts is 2,000,000lbs., so that it is not a petty trade.

Mr. F. Linde has recently published a very useful large scale map of the tea-producing tracts of India, compiled from revenue survey maps, from personal surveys and from reports from tea planters. The sheet comprises maps of all the tea districts, including Chittagong and Chota Nagpore; is carefully coloured (each garden being clearly marked); and is mounted on canvas and rollers. The size is about 6ft. by 3ft.

INDIAN TEA PLANTERS AND THEIR HOME INTERESTS.

If union is strength," we think we are justified in saying that the Tea planting interests of India are lacking an important source of power in dealing with many of their grievances, through their want of some uniting agency which would enable them at need to take common action.

The long distances which separate the various tea districts, and the vast area over which Assam, the largest of them, stretches itself, have seemed hitherto to stand in the way of much intercommunication; and not only has there been little or no concerted action on the part of the different districts, but the individual gardens have remained isolated to an almost incredible extent.

We think there can be little doubt that the occasions are not few when the planters would be great gainers if they were in a position to act unitedly. In all that relates to much needed law reforms, to the imperative requirements in the way of better means of transit, &c., to a host of other subjects, the weight of the vast interests bound up in tea can only be fairly felt when those interests can speak the same thing at the same time.

The Government, both at home and in India, have never shewn themselves indisposed to listen either to claims or suggestions whose source entitled them to respect; and we are quite satisfied that, were there an organisation which fairly represented the various interests of tea growing in India, the Government would not only hear but welcome whatever it might have to say as to improvements in the existing laws or other matters to which such an agency would naturally turn its attention.

Many of our readers will be aware that last autumn a small but influential committee of gentlemen in London, interested in Assam, waited upon the Secretary of State for India, and pressed upon his attention some of the difficulties experienced, especially in Upper Assam, in regard to means of communication. As one result of their action, we understand that the first sod of a new line of some 70 miles of railway in that district has already been turned, while material improvement has been made in the existing highways. Here is a recent and important instance of the advantages that might fairly be expected were a soundly-constituted and thoroughly representative Association to be formed which should unite the various tea-growing districts of India.

We hear that it is under consideration to form such an association, having its head-quarters in London; and provided that its basis is sufficiently broad, we believe it might be the means of incalculable advantages to those whom it would represent.

We shall look with the utmost interest for the news of its actual inauguration, as we believe it is greatly wanted, and we trust its constitution will be such as to insure the adherence of all classes interested in the growth of tea in India.—*Home and Colonial Mail.*

TEA IN JAPAN.

The crop has fallen off this year owing to such low prices in Yokohama, that it did not pay producers to pick the lower grades; finding no market here, they send their teas south per Mitsu Bishi steamers, and also overland.

The numerous tea plantations which exist in the immediate neighbourhood of Niigata prove the fallacy of the idea, that tea plants cannot be reared with profit beyond the 36th degree of N.L. The climate of this district may be briefly described as follows:—S. and S.-W. summer winds creating a slight current setting North, and thus causing an increased temperature; a winter generally commencing in December with N. and N.-W. winds, followed by heavy falls of snow and gradually decreasing temperature, which is at its minimum towards the end of January or early in February. Then come warmer days, the thermometer frequently showing 6 to 9 degrees. Réaumur at midday, followed by heavy snow storms from the N. and N.-W., which continue till the end of March, when the spring may be said to have set in. This season of the year is generally genial, with a clear or slightly cloudy sky, though stormy, cold weather is sometimes experienced. From the middle of May till the end of September the weather is warm, if not hot, the prevailing wind being S.; thunder-storms and heavy falls of rain are not infrequent in July and August. A rainy season is unknown in this neighbourhood. From October the weather is cold and changeable with S.-W. winds.

The snow which covers the ground to a depth of from 4 to 8 feet, is undoubtedly a great protection to the tea plants against the more severe cold of mid-winter. This covering is speedily melted away by the warm south winds of spring, and while gradually disappearing, it refreshes the budding plants. The soil of this part of Japan is a chalky clay, and the tea-fields, situated on the upper slope of an immense plain, extending seaward from the range of mountains some 25 miles from Niigata, are well irrigated by large streams.

Applying these particulars to the luxurious growth of the tea plants in this district, we find:—1st, an absence of intense and continuous cold; 2nd, ample water supply, and fine sunny spring weather, unaccompanied by night frosts; 3rd, continuous summer heat, with refreshing rains; 4th, a temperately warm autumn, during which season the tea plants are in full blossom.

The tea producing places, arranged according to quantity, are Murakami, Muramatsu, Kurokawa, Niitsu, Gosen and Tatemura.

Murakami produces the largest quantity of superior teas, while those at Muramatsu are on the whole preferred in the foreign market; the Kurokawa teas are considered superior by the Japanese to those of Murakami, but foreigners make no distinction between these two sorts. The average annual produce of the various crops of tea is estimated at about 500,000 lbs.—*Japan Weekly Mail.*

TEA CULTIVATION IN RUSSIA.

It is reported that the culture of tea in the Caucasus is to be encouraged by the Russian Government. The plant at present grows freely near Soukhum Kaleh, and experiments by the Government have shown that it can thrive equally well in Mingrelia and Guria. As it is believed that the plant would also flourish in the recently annexed Turkish provinces a tea plantation is to be established at Ardahan. Some years ago it appears that an attempt was made at Tiflis to establish a Russo-German Company on the basis of a Government subsidy to develop growth of tea and place it on the market, but the projectors imagined that in order to roll the leaf it would be necessary to introduce a large amount of coolie labour from China, and as this did not meet the views of the Russian Government, the project lapsed. But now it is thought that the engagement of a few Chinese foremen will be sufficient to secure that the Mingrelian colonists set about the cultivation in the most approved way. Only one more is needed to put the Caucasus in the field against India and China for the supply of tea, and that is capital; but unfortunately the state of the Empire and the abnormal timorousness of capitalists induce the impressions that it will be some time before the tea market will be seriously disturbed by this new competitor. The efforts of the Imperial Government to foster manufactures and trade are never ending.—*Times of India Correspondent.*

COFFEE.

THE following is from the *Globe* :—"According to the 'Statistical Abstract for the United Kingdom, 1878,' the popularity of tea as a beverage increases steadily in the United Kingdom, while the demand for coffee remains stationary. In 1863, the quantity of imported tea retained for home consumption was 758,929 cwts., while in 1877 it was very nearly double, the exact amount being 1,340,311 cwts. On the other hand, coffee fell away during the same period from 292,528 cwts, to 288,268 cwts., a considerable diminution when the increase of the population is taken into account. Nor can the decrease be explained by the theory of a larger admixture of chicory, for the consumption of that article remained almost as stationary as that of coffee. It is a curious thing that a beverage which presents so many advantages for the working classes has not come into wider use. A mild stimulant, a heating agency, and possessing great sustaining power, coffee would seem to be the very thing for those who have to labour for long hours in the open air: but use and wont are on the side of tea, it appears, as strongly as ever, and even the rising generation must yield to their power, or we should see some evidence of an increased consumption of coffee concurrently with the enormous development of tea imports. Perhaps the new movement for coffee taverns may do something in this direction, by unfolding to the working classes the virtues of the berry which they have so long neglected. True, there have been early coffee stalls in the streets for many years past, but the article vended at these establishments is not exactly calculated to create widespread popularity. The curious decoction may possibly be sustaining and heat-giving; so far as thickness goes it leaves nothing to be desired. But the flavour is distinctly nauseous, and the sediment so plentiful that, as a workman was once heard to remark, 'one gets meat and drink at the same time.' In former times, it was not very easy to obtain a good description of berry except at a high price. Now, however, Ceylon, Costa Rica, and Southern Madras produce very fine qualities, which can be bought at much lower rates than the so-called 'Mocha,' and are quite, if any, inferior to that standard of excellence."

LEAF DISEASE.

(*To the Editor "Ceylon Observer."*)

DEAR SIR,—In these times when a cure for leaf disease is so much wanted, I consider it worth while that the following process, how to apply sulphur in a *liquid* state to the coffee trees, should be as widely known as possible; the great advantage of it is that it can be *best* done in *dry* weather. The difficulty is to get the sulphur to mix with water, but by the use of *soft soap* that is easily overcome. Mix 29 lbs. of flowers of sulphur with 4 lbs. *soft soap*, work the two well up together, and add water, very gradually at first, until the quantity is made up to 13 gallons. I find this quantity will do 200 trees well. Apply with a common garden syringe, which should be held under the tree, so that the mixture may be forced up on to the under side of the leaves. A good deal falls on the ground, and the stems and branches should also get a coating of it.

Old beer casks cut into halves make excellent tubs for making up the mixture in.

Labour.—One cooly mixing, one carrying water, and one using the syringe can do an acre in two days.

Cost of sulphur in *London* is 11-6 a cwt: soft soap 14 *s.* per cwt.

I have just done an acre here very successfully, the weather having been very favourable for the application, and if it is not attended with much good I shall be disposed to give up all endeavours to get rid of *Hemeleia vastatrix* as hopeless; time will shew. I ought to add that Mr. Morris saw the coffee to which I have applied the mixture, and thought the experiment will be a very fair one.

For the most of the foregoing information I am indebted to Mr. Charles S. Hadden, who was a planter in Ceylon, more than thirty years ago.—Yours truly,

Waygalla, May 10, 1879.

J. F. MOIR.

Note.—2 cwts. sulphur, and 32 lbs. soft soap, were used in doing 1,600 trees.

THE EFFECTS OF NEW COFFEE.

THE *Handelsblad* of the 15th March says:—"With regard to the Netherland vessel *Bastian Pot*, which left Chilachap on the 4th February last bound for Rotterdam, we learn the following details. Shortly after she left the port, frequent cases of fever occurred on board, and with such a violence that the captain died on the 11th February, followed by the mate, the carpenter, and seven of the crew, making a total of ten deaths. There remained nine of the crew, who were also attacked by the same disease, and they were so weak at one time that they could scarcely stand up. Other calamities, however, came to make their situation worse, stormy weather prevailing with very high sea running. The strongest among them then decided to tie up the rudder, leaving the sails standing, and in this position they prepared to meet their fate before the wind and the current. On the 6th March they fell in with the British barque *Magnificent*, which immediately rendered them assistance. The captain of the *Magnificent* sent on board the disabled vessel his mate and five sailors to convey the vessel to Batavia. During the latter voyage there were no more casualities, but the nine men were in such condition that necessitated their immediate removal to hospital on arriving at Batavia. The deaths are attributed to the foul air emanating from the cargo, which consisted of new coffee. Last year a vessel was dispatched from Penang with the same cargo for America and the same phenomenon occurred."

The *Dagblad* of Batavia, in its issue of the 19th March, says:— "Eight seamen, the survivors of the crew of the *Bastian Pot*, who fell sick at sea, and had their vessel towed to this port by the British barque *Magnificent*, have been conveyed in carriages to the hospital. The *Magnificent* met the *Bastian Pot* in a disabled condition, with eleven corpses laid on the deck; these men presented a frightful appearance. If it be true that damp coffee produces such fatal consequences, as occurred on board this vessel, measures must be taken to prevent the recurrence of this danger."—*China Mail.*

NOTES FROM COORG ON ROAD CONSTRUCTION.

Mercara, 21st April 1879.

ONE of the exemplars of the "Inge Va" is calculated, I think, to perpetuate a very natural error in the treatment of roads. The civilized instinct we are educated up to, teaches us to clean everywhere, "Rôattilê oru maniyam uddâ," and so the road is to be swept clear of the loose earth, but let us examine. The object of a road is the smoothest possible uniform surface line of communication for facile movement along.

The invariable defect that impairs this theoretical condition is stones cropping through the surface of the road—unless indeed undue traffic has patched it, when it clearly requires macadamizing —*ergo* the more earth the better.

It is the denudation of the earth covering from the existing stones that as a general rule makes a road dangerous and disagreeable. This results from, 1st, natural tear and wear; 2nd, avoidable damage by rainfall being allowed to accumulate and run further distances on the road than necessary; and 3rd, denudation can be in some degree accelerated by the "Inge Va" process.

Now to the second divison of my subject, to which the first is a sort of text. I intend nothing less than a reform of heavy account in the very mould and form of the roads of the future.

Engineers will be at one with me in estimating that the heaviest items of expense, and the processes requiring the greatest proportion of care and skill on roads, are the barreling, culverting and draining, next the bank cutting. I submit that all this might be avoided with the effect of having a better road at a greatly diminished first expense, and after up-keep, by simply sloping the road continuously across its breadth from the side cuttings to its outside fall—no upperside drain whatever nor under culvert, save where a hollow or ravine would accumulate more water than could pass across the road without injuring it; the ordinary down wash upon side cuttings will never result in great comparative damage if only the road be sloped to the lower side. There must be no mistake about the slope however; it may be a very easy one, but there must be no defect in its extension to the outside edge of the road. A quarter inch depression to permit the water to run along the road accumulatively will wear away the road in a valueless manner, and such a road should therefore be the subject of unceasing inspection.

On level roads the water clearance grade may be so low as to be barely perceptible; as the road gradient increases, the clearance grade must increase to shorten the necessarily diagonal course of the water flowing evenly across the road when rain is falling.

I speak not without book on this subject as I have had roads on this plan under my eye for about 20 years, none however macadamized, but were this tried it would only, I think, more plainly prove the efficiency of the system; and the grand result would be two, aye may be three or four, miles of road at the expense of one.

The roads, Macadam brought his great improvements into practice upon, were through level countries with the watershed, so to speak, changing at short distances right and left of them, and the ancient road traces breasted the hills straight up and down, when it would be a moot point whether barreling would not be the best plan, but with our roads, mostly side cuts, the economical enlargement of road breadth, consequent upon avoidance of the dangerous drain on the inside margin, would be a welcome improvement.—*Ceylon Observer.*

CINCHONA.

CINCHONA IN THE LONDON MARKET.

DEDUCTIONS FOR ANALYSIS, &c.

WE print, as we have a right to do, the following document for the information of our readers :—

Account sales of cinchona bark received ex *Benledi*, Captain Paterson, at Colombo, for account of the proprietors of Abbotsford Estate, a/c 1878-79.

Abbotsford, &c.		c. qr. lbs.		
2 Bales Cinchona Bark		2 0 18		
		21		
	c. qr. lbs.			
10 „ ...	11 1 21	1 3 20		
	3 23			
	10 1 26	216		
		6½		
	1174	209½		
	85¼	8	per lb.	
	1188¾	201½ at	7/7	... £ 76 8 1
	43¾			
	1095	...	4/10	... £ 264 12 6
1 „		0 1 20		
		7		
	c. qr. lbs.	0 1 13		
4 Bags ...	1 1 9			
	12	41		
		1½		
	1 0 25			
		39¾		
	137	1½		
	4			
		38¼ at	1/5	... £2 14 2
	133			
	5			
	128	...	2/6	16 0 0
17 Packages				359 14 9
		Disct. 2½ per cent.		8 19 10
		CHARGES.		£350 14 11

Sea Insce. £250 at 22/6 per cent. and Duty ...	£2 17 0	
Freight 50/ per ton of 800 lbs.	5 7 0	
Sale charges	0 15 0	
Brokerage 1 per cent.	3 11 11	
London Dock charges	2 11 0	
Fire Insurance	0 5 0	
Interest on charges	0 0 8	
Commission and guarantee 2½ per cent. ...	8 15 4	
		23 18 11
To credit of the Proprietors of Abbotsford Estate a/c 1878-79 p. 31st March 1879.		£326 15 0

London, 8th April 1879. E. E.

The agents through whom the sales were effected being of the highest possible character, it must be taken for granted that no deductions for loss of weight, analysis, or other reason or purpose, would be permitted which were not justified by the customs of the trade. But, undoubtedly, the deductions seem large, and, in the case of the bark which sold at 7*s.* 7*d.* per lb., they represent a considerable sum of money. The original weight of the two bales as shipped we suppose was cwts. 2-0-18, say 237 lbs. (This is reduced for loss of weight, or tare of packages ;) by 21 lbs. Then we have deduction (for analyses we presume !) of first 6½ lbs. and next 8 lbs. The quantity sold is thus reduced to 201½ lbs. or 35½ lbs. less than the quantity shipped, if the first deduction was for loss of weight. Loss of weight, of course, when it occurs, cannot be helped, though we should rather expect an access of moisture during the voyage. But the after deduction of 14½ lbs. seems large. We understood from Mr. Bowson at Neddiwuttum that the Government cinchona was packed in bales of 102 lbs., so as to leave 100 net, after the odd 2 lbs. for analysis were taken. That was all he seemed to calculate on. 14½ lbs. at 7*s.* 7*d.* represents a sum equal to £5 9*s.* 11½*d.* In the case of the 10 bales which sold at 4*s.* 10*d.* the deductions are large in proportion to quantity. As shipped that quantity appears to have been 1,231 lbs. The first deduction from this weight was 107 lbs. Then came 35¼ and 43¾, together 79 lbs. The quantity sold was thus only 1,095 lbs. We need not go into the details of the other packages.

Perhaps those who are better acquainted with the customs which regulate the sale of bark will explain why there should be such large deductions. Surely, 2 lbs. out of every hundred ought to be ample for analysis, that analysis to be made not by each intending purchaser for himself but by a chemist in whom all could place confidence. Eye and microscopic examination would, of course, be open to all.—*Ceylon Observer.*

CINCHONA CULTURE IN JAVA.

THE " MOSSING SYSTEM " IN CINCHONA CULTURE.

Report of the Commission appointed by the Government order of 29th March 1878, No. 29.

(*Translated from the Dutch for the Ceylon Observer.*)

THE intention of the Government order dated 29th March, No. 29, was that we should give our testimony regarding the question of the gathering by renewal of bark, as was recommended in British India by McIvor.

In Java, the mode of gathering the cinchona bark has been hitherto governed by the necessity of, in the first place, thinning out the plants, and when the superiority of *C. calisaya ledgeriana* was discovered of gradually removing all species of cinchona, with the exception of *C. succirubra* and *C. officinalis*, and substituting *C calisaya ledgeriana*.

A portion of the *succirubra* and *officinalis* plants is now sufficiently thinned out, and the question arises how much further operations should be carried on in order to cultivate the plantations in the most profitable manner .

In the British Indian Colonies, there exists a difference of opinion as to how this is to be done, and the two modes hitherto proposed are called " Mossing " and " Coppicing."

The Colonial Government appointed a commission to decide the value of both systems, but this commission came to no final decision. The chief defender of the first system is McIvor, who was the first to recommend it. Strong doubts as to its good results were raised by Broughton, and it was uutterly rejected by Dr. King.

The " Coppicing " system is nothing more than the cutting of the tree down to a stump, whereby, naturally, the whole of the bark of the felled tree can be gathered. From the stem young shoots make their appearance which will yield bark for a subsequent harvest.

In mossing, the tree is not felled, but longitudinal strips of the bark are taken off the stem to a height as far as a man can reach, and alternate strips of equal breadth are left on the tree. This operation performed, the tree is immediately enveloped with moss. On the denudated portions of the tree, the bark is reproduced, and in about a year the bark has become so thick that the strips of old bark, which were left by the operation, can be removed without injury to the tree. Then the stem is again enveloped with moss, and the following season the bark newly formed on the places whence the first strips were removed is gathered. Proceeding thus, the half of the stem bark is gathered alternately, and one can in this way derive produce from the same tree for many years.

This at least is the purport of the theory of the inventor of the system.

If all goes on exactly as described, then both systems may be considered as good, but the latter as deserving preference.

Both systems, as they have been applied in British India, have the disadvantages. The figures which indicate the amount of bark which a tree treated according to both systems can yield unmistakably in favor of the mossing, though as yet these figures have been derived from Mr. McIvor, who was very prejudiced in favor of his own method. In the second place, the stumping was performed in British India in an altogether wrong manner. That is, the cinchona trees were treated like oak copploes, and all the shoots which appeared on the stump were allowed to remain. On account of this, both less and poorer bark was obtained.

It is evident that the bark of the shoots is of a much poorer quality that the bark obtained by the 'mossing' system. But the result might have been foreseen, since in this manner poor bark of thin branches is obtained, and it is a fact universally known, that thin branches give thinner (and therefore less) bark, and this bark contains a smaller quantity of good alkaloids.

Therefore also the opponents of the stumping system calculate that a tree, eight years after the operation, will produce scarcely as much bark as an eight year old tree raised from seed.

Had the method been brought into practice in a rational manner, and, as is the case here in the Government cinchona enterprise, of all the shout only a single (the strongest) allowed to remain, then not only would much more bark have been obtained in the same period, but the bark would have been thicker and of a better quality.

Certainly it is well-known that the sprouts of a tree that has been stumped grow much quicker than seedlings, and become much more speedily of a certain thickness. And in regard to the cinchona this fact is confirmed.

An objection to the system may be that after stumping one portion of the tree it no longer buds. Certainly by choosing the proper season viz.

just after the commencement of the rainy monsoon), the evil can be averted from a portion, though not from the whole, more particularly the old trees. In British India a large proportion of stumped plants always died.

Here, however, this evil has been scarcely experienced, and where it does show itself, it can be speedily remedied by digging out the dead stumps and substituting cuttings. *Succirubra* bears stumping the best; *C. officinalis* and *ledgeriana* also succeed very well.

In practice it is seen that the other system also has its drawbacks. The greatest of these is that, in the case of *C. succirubra* at least, the operation often gives a very uncertain result. So that Howard in his work on the "British India Cinchona Plantations," speaking of the value of both systems, says: "I have grave doubts of the possibility of carrying out the plan of renewing the bark with commercial success."

The consequence of young plants bearing the operation better than old, is that it cannot be performed repeatedly on the same tree, and thus moreover, no yearly crop can be obtained.

If the operation does not succeed, *i.e.*, if the bark does not renew on the bared places, then much is lost. The wood on those places which come in contact with the atmosphere, rots, and the death of the tree generally follows. In South America the Cascarilleros also tried the same system, though in ruder manner, and the death of the tree was the inevitable result.

It is true that an intelligent treatment here can counteract much evil. The partial stripping can be done with much less injury when there is proper skilled supervision, than when it is entrusted to the 'Cascarilleros.' In enclosed plantations a skilled person can take care that as little as possible of the cambium layer is removed, without which a renewal of the bark is impossible.

A partial stripping may result in the tree drooping for a time, and it has been asserted that not for a year after the operation did *succirubra* trees regain entirely their healthy and vigorous appearance.

With us this has not been confirmed. Some *C. succirubra* trees languished, but then it was found also that the new-formed bark had been destroyed by termites.

The bark had therefore not been replaced, but nevertheless, the trees still live two years after the operation, and appear very healthy.

Both new-formed bark, and the old bark, which has been for a season under moss, are of better quality than the original bark.

Mr. Broughton states that *C. officinalis* is much better suited for this system than *C. succirubra*, and it was therefore of great importance that it should be determined how far in practice it could be applied to the *ledgeriana* species. An experiment with three ten year old, *ledgeriana* trees failed completely. One tree died; on the other two, the bark did not renew. The trees drooped for a time, but now, 1½ years after the experiment, they look exceedingly healthy. In the case of young *ledgeriana* trees the replacement of bark after partial stripping succeeded speedily and completely.

A good comparison of the two methods, and a decision of their relative merits in the industry, is only possible after careful experiments with the various kinds. The stumping must then, for a proper comparison, not be carried out as in British India, but, as is always done here, only one shoot must be left on each stump.

The quantity of bark produced by a tree under both methods must be carefully weighed, and the quantity of the bark determined by analysis.

Only the experiments of a long series of years can give certainty in this matter, since it will then be incontestably proved how many times a tree can undergo both operations.

Nevertheless—and it is the chief object of this report to demonstrate the truth of it—it appears to us that in the mossing system also a wrong method has been pursued in British India, and that an improvement must be introduced which will remove almost all the objections to this system and increase its advantages.

So far as is known, the cinchona bark consists of separate layers. And it seems certain that the alkaloids whose existence chiefly determines the value of the bark, are almost entirely and altogether found in the outermost layers of bark, consisting for the most part of cells, and only to a small extent in the innermost layers, which contain more bark fibres. Repeated and careful chemical analyses by Howard, Broughton, and Moens appear to lead to no other conclusion.

Some indeed go so far as to assert that, the more cells and less bark fibres are found in a bark, the better it is. And indeed, it appears to be the fact with regard to barks of the same species of cinchona, for old bark, covered with moss for a certain period, contains more cells than the original bark and contains also more alkaloids.

Renewed bark contains even less fibres than mossed bark, and always fetches in the market a higher price.

If this is true, then the deduction is evident *viz.*, that by gathering only the outermost bark, but little of the alkaloids is sacrificed, and the gathering is almost as profitable. Moreover, packing and transport are then incurred only for rich bark, whilst by gathering the whole of the bark both sources of expense are incurred for the innermost fibrous portions which are of very little value. Besides, when the innermost layer is left on the tree, the danger of removing the cambium layer, which is situated between the liber and the wood, is entirely avoided.

A priori, therefore, the proposition is not absurd, that, instead of as in the British India system, gathering only half the bark, the outer bark of the whole circumference should be gathered without any injury to the tree.

If the tree bears the operation, the bark will be able also to renew itself more speedily, for by the method of McIvor the tree is increasingly hindered in its growth, and thus also the formation of new bark must be hindered. An analogous case is the following: The outermost bark of the cork tree is continually removed, and the trees bear this operation for more than a hundred years.

The two cases are certainly not entirely alike, since in the case of the cinchona, another, and in comparison greater, portion of it must be removed, which also takes more part in the life operations of the plant, than is the case with the cork tree.

Proceeding in this theoretical view, an experiment was begun in February 1878, in connection with the Government cinchona enterprise. The investigation as to whether that view is established by fact must naturally be double: anatomical and chemical.

The results of the first are given as follows:—

If they are confirmed by the chemical analysis which will be carried on during 1879, then it appears a legitimate conclusion that scraping (so the method may be called,) in regard to species rich in quinine, is above all other methods of gathering far-and-away preferable, and yields much better bark and much more speedily, without injury to the tree. The outward appearance of renewed bark is entirely different to that of original bark.

Therefore the operation cannot be carried out in connection with the barks poor in quinine (so-called pharmaceutical barks), which are valued by appearance, but chiefly in connection with barks rich in quinine (so-called manufacturers' barks) whose value is determined by analysis.

Here follow the particulars of the microscopic investigation:—

For mutual comparison, original barks both *C. succirubra* and of *C. calysaya ledgeriana* were taken, also barks which had passed some time under moss, such as were renewed according to the method of McIvor, and such as were renewed after scraping off the bark.

In the application of the method of McIvor, experiments were made as to the possibility of substituting in place of the moss a covering of *injuk*, which offers practical advantages. Some trees were left entirely uncovered.

After the scraping, one portion of the trees was covered with moss, an equal proportion with *injuk*, while a third was left bare.

So far it is observed that the scraping has produced no ill effects on the trees. They have not been checked in their growth, and have not shed their leaves on account of the operation.

Externally the barks obtained by these various methods are easily distinguished from each other. The original bark has a light-colored or whitish exterior, attributable to the lichens growing on it. By mossing, these lichens seem to die, and the bark acquires a much darker appearance, whilst here and there small knobs are formed like great lenticelles. Renewed bark, after partial stripping of the tree, is still darker externally, its entire upper layer is smoother than that of the original bark, which has been long under moss, whilst the above-mentioned knobs are much more numerous. Finally, the bark renewed after scraping, is even darker externally, but smooth and without knobs.

Bark which has been covered with moss is much more brittle than original bark, and renewed bark even more brittle still. As the brittleness increases, in proportion as the bark fibres decrease in number, whilst at the same time the cellular tissue, which contains the best alkaloids increases, mossed bark is better than original bark; renewed better than the former.

Bark is renewed much more readily after scraping than after partial, stripping.

After scraping, not one of the trees, even those which were left bare, was backward in renewing its bark, whilst most of the trees which were partially stripped and left uncovered had renewed not at all or very little, and some even of those which were covered with moss and *injuk* were very incompletely covered with new bark. From this it appears that scraping is much less injurious to the tree than partial stripping.

The renewal takes place infinitely quicker in the scraping process than in the partial stripping. Renewed *Ledger* bark had, three months after the scraping, attained to three-fourths of the thickness of the original bark, and would thus in one year certainly be as thick as the original bark; whilst the bark, newly formed two months after the partial stripping, had a thickness of scarcely one millimetre. Since 60 eleven year old scraped *Ledger* trees, after a scraping reaching to about 5 feet from the ground yielded 50 kilograms of bark of superior quality (better than that hitherto brought to the market, as the worthless fibrous layer was wanting), It may be confidently asserted that one year after the scraping, an equally good crop may be obtained, and each *Ledger* tree can thus yearly produce about 1 kilo of bark of the best quality.

Succirubra appears, also after scraping, to recover less quickly than *Ledgeriana*, and this method is, therefore, for the latter species as indicated. [Not so suitable?—Ed. C. O.]

Under the microscope the renewed barks can easily be distinguished from the old. In order to give a regular review, we shall now relate what the microscopic investigation taught regarding *succirubra* bark, and those of *Ledgeriana* will then be dealt with.

The original bark of *succirubra* had entirely the composition which has been described and represented by different authors. Nevertheless and this applies to all the hitherto examined barks, whether they were first

dried and then boiled in water, or whether preserved in glycerine immediately after gathering,—no crystals were observed, such as were seen by Howard continually in abundance, but whose existence is doubted by others.

The sap tubes were very plainly recognisable. The cells of the cortex and liber (basal tissue) were in the original bark all arranged in tangential rows, and all tended in the same direction. The cells of the medullary rays naturally have another direction.

After remaining 13 months under moss, the bark of the same tree had become considerably thicker. The bark fibres increased in number very little, and the thickening is almost entirely due to the cell layers of liber and cortex, or to the outermost portion of the whole bark. No wonder, then, that "mossed bark" fetches higher prices in the market, and that chemical examination indicates a higher amount of alkaloids in it.

On account of this disproportionate increase of the cellular tissue the fibrous layer is surrounded by a thicker layer of cells and the first is removed further from the circle of sap tubes. The medullary rays are much more clearly visible than in the original bark, and are greatly enlarged towards the cortex, which indicates a quicker increase of cells in that place.

The barks renewed after partial stripping and covered with moss for 13-16 months have, under the microscope an entirely different appearance from original bark. In the first place, in all the specimens examined almost all the cells of the cortex and bark are arranged in radial rows, so that renewed bark is recognisable at the first glance. Moreover, the cells which are larger than broad, always have their greatest length in a radial direction. In the second place, we have observed no sap tubes in renewed bark.

Finally, the layer containing bark fibres, is very small and constitutes only one-fifth of the whole thickness of the bark.

These fibres are however placed very thickly together and separated from each other by only very small medullary rays. The absence of sap tubes is observed in barks of different species, especially in full-grown barks, and as these latter are, as regards quality and quantity of alkaloids, better than younger ones, the sap tubes are certainly not the seat of the alkaloids. The absence of sap tubes in renewed bark is therefore no sign of inferior quality.

From the anatomical structure of renewed bark, therefore, it may be inferred that it is richer than mossed bark, and this is confirmed by analysis.

From the examination of bark renewed after scraping it appears that when only a little of the original bark remains over the cambium layer, the renewing orginates wholly in the cambium, and thus the inner layer of old bark which remained after the scraping is thrown off like leathery cork.

This layer then forms a protecting covering round the cambium and the young bark. If the scraping is less thorough, so that a thicker layer of original bark is spared, then this is not thrown off as cork, but the new forming proceeds [orig. 'ontstaat' may also mean "fails"] from the medullary rays to the outer edge of the bark fibre layer. The structure of bark renewed in this manner is the same as that which appears after a partial stripping and covering with moss.

We also examined bark renewed on various parts of the stem after partial stripping.

It appears from this that the bark which was renewed at the lower part of the stem contained more bark fibres than that which had formed on the upper and middle portions of the stem. The chemical analysis, which showed more cinchonine for the bark renewed on the lower part than for the other pieces, made their composition readily apparent.

In the description of old and renewed barks of 'C. *succirubra* in his "Quinology of the E. I. Plantations" Howard also mentions "abnormal formations" or "cells filled with granulations of some earthy compound." These are very thin-walled cells, entirely filled with dark contents and which, equally with the other cells, are in original bark arranged tangentially and in renewed bark radially. In the latter they are seen in greater number and also between the bark fibres, whilst in the case of the original cells they are met with only in the outermost layers, outside of the ring of sap tubes. In this above-mentioned work Howard speaks of 'spiral vessels,' which he saw in renewed bark. According to his sketch, these are not vessels but prosenchymatous cells, and their appearance in the cortical layer, which otherwise is always composed of parchymatous tissue is very remarkable. These cells were not noticed by us. We did indeed see in *succirubra* bark, renewed 2½ months after stripping, in longitudinal sections, cells having some resemblance to these, but they were only speckled and showed no spiral or step-shaped thickening. These cells moreover did not belong to the bark but are products of the woody portion of the cambium layer. They are medullary radial cells or wood-parenchyma cells with a somewhat abnormal position.

Mr. Broughton states that the new formation of the bark begins at the lower part of the surface of the wound, and so proceeds. The experiments made here have not confirmed this. The formation of new bark begins at all parts of the surface of the wound in many places, unconnected with each other, although naturally on the edges of the wound the new forming begins first, and proceeds most rapidly.

Later on a very remarkable piece of bark of C. *succirubra* was examined. One of the managers wished to strip a tree partially, but in place of removing the loosened strips, he allowed them to remain fixed above and below, so that the union with the tree remained. The bark partially renewed on this wood. On the inner side of the loosened strip of bark, however, a new formation had also taken place, which, however, on examination, proves to consist of woody fibres.

The bark of *ledgeriana* cinchona has under the microscope an entirely different appearance to that of *C. succirubra*.

Even less than in the latter are crystals to be discovered in *ledgeriana* bark, whether in original or renewed. Sap tubes are found in original bark only in very solitary instances, but never in renewed bark. Where they are present they are considerably smaller than those of *C. succirubra*.

In original barks the cells of the cortex are invariably arranged in tangential rows, and in renewed barks, in radical rows.

In scraping, the innermost layer of the original bark, which is left, changes just as in the case of *C. succirubra*, and the new formation, if the scraping has been deep enough, proceeds entirely from the cambium New-formed bark is, morever, much poorer in bark cells than original bark.

Renewing takes place much quicker after scraping than after partial stripping.

In original *ledgeriana* bark, besides the usual cells, three other forms of cells are seen, which deserve separate notice. Two-thirds are thin-walled and filled with opaque matter. Of these one kind, which is entirely filled with that substance, is seen in the outer portion of the cellular tissue, and these are, like the last, extended in original bark very markedly tangentially, and in renewed very markedly radially. The second kind, whose contents are much smaller than the cell-wall, are seen in the deep layers, between the bark parenchyma, and are almost round or square. Both sorts are found in all the examined barks, but in renewed bark in greater number.

The third kind of cells have an entirely different appearance, and are called by Howard resin-cells. They have a very strong thickened well, with very plain pore-channels, only occasionally branching. The contour of the cells is more four-cornered or angular than those of the surrounding cellular tissue, and they are readily distinguishable from the latter not by their greater size but by having different contents. These are transparent, insoluble in pure boiling alcohol, are colored, not blue but dark brown by iodine, and only partially fill the cell. The cell-wall itself is, like the bark fibres, colored light yellow by iodine.

The thickening of the cell-wall is often very disproportionate. In all original barks these cells are found in only two or three layers of the outermost cortex, immediately under the cork-forming layer. Very rarely two or three lie next each other and their number is small.

In barks renewed under *injuk* moss after scraping and after stripping, the same cells are much larger and sometimes extended radially in a marked manner. There are also scattered irregularly throughout the whole cellular layer, but they always end where the bark fibres begin. *By the appearance* of these cells, not only immediately under the cork layer, but in the whole broad cellular layer of the cortex, barks renewed under *injuk* and moss can be immediately readily distinguished from original barks. This renewed bark agrees in anatomical structure very closely with the *Quina Roja* of Mutis, described by Howard as fig. 26 on Pavon's *Nueva Quinologia* both in the broad layer of these resin-cells, and in the absence of sap tubes. Only the cells of the renewed barks are much less in number.

In the same work a study of Harsten on cinchona barks is reproduced, and the latter says: The resin-cells disappear contemporaneously with the formation of the organic bases, and elsewhere again that resin-cells are found very scarcely, or not at all in the better barks.

This may be the case with regard to some species; certainly the appearance of these cells need create no fear in the breast with regard to a poorer quality of *Ledger* bark, since their appearance in abundance is coupled with an increase of the cellular tissue and a decrease of the bark fibres since also in the original *Ledger* bark, which is so rich in quinine, these cells are seen; and since, on the other hand, in *succirubra* bark, which is of much less value than *ledgeriana*, these cells are wholly wanting.

In bark, which has been left uncovered after sand scraping, the renewed bark is almost as thick, though the above-mentioned resin-cells appear scarcely in such numbers, or so widely distributed as is the case with original *Ledgeriana* barks. Thus, covering with *injuk* and with moss after scraping does not give more bark than when the covering is omitted: otherwise the anatomical structure and the chemical analyses will decided which method of treatment is to be chosen.

Covering with *injuk* modifies the bark in the same manner that moss does, and it may be supposed that any thorough shutting out of light and heat would have the same effect.

Naturally, analysis must confirm the exactness of the results, but the anatomical investigation appears to teach that scraping is far-and-away preferable to partial shipping, does not injure the tree, and that the continuance of these experiments is legitimate and of great importance. This method of treatment will enable the planter to gather yearly about a kilo of bark of superior quality from each *ledgeriana* tree.

J. C. BERNELOT MOENS.
R. H. C. C. SCHEFFER.
The Commission.

Bandong, Buitenzorg,
11th January, 1879.

CACAO.

PLANTS of cacao are for sale at the Peradenia Gardens at one rupee a dozen, but the Trinidad variety is more popular, doubtless for the reason that it is hardier and gives bigger crop. We have been hearing on all hands ever since cacao has been recognised, as having a great future before it here, that to plant and grow it successfully, the young cacao must be shaded; indeed, this is the recognized method everywhere, but a proprietor of a place at Kadugannava was telling me that he thought this was a mistake; he had planted up his estate there—at stake,—did nothing whatever to shade the young plants, and that they are strong, healthy, and doing well. This, it seems, was not the happy luck of a favourable season. For before he committed himself fully he had tried the previous season, a small portion only, and finding that successful, had more courage to adventure further; this style of it would be a wonderful saving to what at present obtains, but in the matter of a new enterprise, where so much depends on its getting a fair start, it may be a question whether, after all, the extra outlay at the beginning to thoroughly ensure its complete success, is money thrown away. However, I am a long way from my text, which was Simmonds' book and his article on "Cocoa." This is the completest thing I have yet seen on the matter, indeed, it is somewhat confusing in its completeness, as you have the culture and curing in different places, and they don't always agree. However, there is much to be learned from it; a wrinkle worth knowing for those who have cacao beans to ship, is that the red colour which is often appreciated by buyers may be got up by artificial means; red earth, brick dust, and even vermillion having been used for this purpose. Another fact which seems to be established is that the Caracas and Trinidad varieties don't do well together: the latter has a very bad effect upon the former, and in Venezuela persons found introducing the Trinidad variety were subjected to corporal chastisement.—*Madras Times.*

AMIDST all the prevailing trade depression it cannot be said that coffee holds a bad position, whilst as regards another kindred product, in which Ceylon will soon be largely interested, cocoa, the market value is steadily on the increase. The latest advice in the *Public Ledger* of April 25th, was to the effect that brisk demand prevailed for all descriptions of cocao, resulting in large sales and re-sales, and rapidly rising prices, closing at a general advance of 10s., and for Guayaquil 15s. Grenada is now quoted 102s. to 105s., fair Trinidad 107s. to 110s., and business done in good Guayaquil at 120s. The deliveries for the week amounted to 1,625 bags, whilst the landings were only 877 bags, chiefly Colonial. One cause of this favourable position of the article is no doubt to be found in the great falling off in the exports from Trinidad, one of the chief producing countries: the shipments for five months in the present and past years, stand as under:—

				lbs.
1878-9 ...	...	...	...	4,523,880
1877-8 ...	...	...	...	6,655,450
			deficiency—	2,131,570

—*Ceylon Times.*

TOBACCO.

HAVING reason to believe there will be a great demand next year for first class tobacco, properly and cleanly cured, I will endeavour to show your planters how they can produce such tobacco, and compete with the American tobacco growers.

1st. Let them abandon the old method of scratching the ground only a few inches deep with a wooden plough. They should plough at least twelve inches deep, and loosely, letting the ground rest for three or four weeks, after which your planter should collect all the refuse vegetable matter he can, put it in a heap, and when dry, burn it, so it will be ready to scatter over the ground before the second ploughing. Previous to the second ploughing it would be well to run a coarse harrow over the field, that all the large lumps or clods may be broken, then scatter rather heavily, say half inch over the ground, the burnt ashes, which lightly plough, in cross ways or in a different direction to that before, again harrow once or twice over, then evenly and with care lay off the ground for your plants; in America and England the ploughman in laying out the ground for plants, makes use of poles set in the field at stated intervals. If your climate be a moist one the planter had better hill up the ground, say 8 inches high by 18 inches diameter, in each hill put a healthy plant, the hills had better be formed with a hoe, an implement not unlike the *mamooty*, with a handle 4½ or 5 feet long. One man should hill up two acres daily. However, in southern India, I would plant on the surface, so that the plants can be the more readily irrigated. Before you set out the plants the ground should be well irrigated and if possible in dark weather, or after the meridian sun has past. Be sure your plants are set in straight rows every way, so that the air can easily pass through; each plant should be 3 to 4 feet apart, care should be taken in irrigating, so that all the plants will get the same quantity of water. But tobacco once planted out and set (growing) need not be watered every day—three times weekly will be amply sufficient. Do not water your tobacco in the morning, if you do, the heat of the sun will cause the water to evaporate, and harden the ground; rather water in the evening so giving the water all night to penetrate to the root of the plant. Be careful not to allow any weeds to grow between the plants; pull all up, and keep the plants well earthed up, to the first leaf. should your plants be looking puny or delicate, place round each plant a handful of burnt wood ashes, or better still, poudrette, mixed with five parts of good earth this should be done after the plants are watered, otherwise the fine and dry manure will be washed away from the plant, whereas the manure, if used after watering, will immediately soak into the ground. Mr. Buck (Superintendent of Agriculture, North-West Provinces) in his pamphlet says "top the plant when eight leaves come out." I cannot agree in this, for during several years' experience, both here and in America, I have always found a good healthy plant capable of producing 12 to 15 good leaves. Of course the suckers must be plucked off, and the plant topped when the leaves are but half-grown. Many American planters only nip the top when the blossom appears. Again Mr. Buck says "do not allow the bottom leaf to draggle the ground." Neither can I agree in this, but say, "by all means allow the bottom leaf to remain," by doing so, you save the second leaf from contract with the ground, and can cure it free from sand. Your tobacco will be fit for cutting when the color changes from a deep green to a shade of yellow; but many of your planters cut their tobacco too green, consequently it is a difficult matter to cure such tobacco evenly. In America when the tobacco is ripe, the lower leaves are first plucked, and cured by themselves, and sold in the month of December as primings at a price of 3 cents to 5 cents per pound. The stalk is then cut just above the ground (the root being left to rot, and manure the ground.) By no means allow the tobacco, as soon as cut, to be thrown in heaps on the ground (Indian style); if you do, it will very quickly discolor and ferment, and no man can afterwards properly cure the same. The American planter, always when cutting his tobacco, is accompanied by several boys and a very clean cart, and as fast as the stalk is cut, the boys carry and place the tobacco carefully in the cart, by which it is taken to the curing shed, there it is carefully handled, every two stalks tied together and placed on poles, no two stalks being allowed to touch; when half cured the stalks are stripped, and tied up in hands or bundles, and the leaf thus bundled nicely packed on a boarded floor and frequently turned, until thoroughly dry and cured, when it is packed away in hogsheads containing about 1,500 pounds for sale; the stalk is always thrown into a heap to make manure for the next year. If bright tobacco be required the American planter dries his tobacco as much as possible in the sun, and allows it to remain several nights in the dew; this dries the tobacco quickly and brightens it. In America the bright leaf commands the highest price, for fancy brands of smoking tobacco. Fair bright tobacco will bring a price of 27 cents to 35 cents per pound. Five years ago I saw a lot of pure golden leaf tobacco sold in Richmond, Virginia, at the great price of 300 dollars per 100 pounds. In America the price paid for common fillers is from 7 cents to 11 cents, and for wrappers (outer leaf) from 14 cents to 22 cents. Extra fine wrappers will bring exceptional prices for fancy brands.

Last year I saw a piece of ground in the Madura district, not quite an acre, planted with tobacco; the produce was very fine. I was told 1,500 pounds. It was grown on rather poor ground, but well manured with burnt vegetable matter; but this tobacco was all spoiled in the curing. as soon as cut, it was thrown on the ground in heaps where it was allowed to remain for two days, and when it was taken up the leaves were all spotted and discolored, and full of sand.

Is it not as easy to handle the tobacco as in America, when you are certain by so doing, you will obtain a much better price. The best shed for curing tobacco is a long open one, roofed only, with the eaves coming down low to keep out the rain, and moveable ends; the tobacco should be hung so as not to *touch* and have all the air possible between the rows. If you wish to export your tobacco to England, you should select the largest and strongest leaf, and all of a uniform color. I would advise that all tobacco for exportation, be first stemmed then neatly tied in bundles as nearly as possible 1½ pounds weight. The advantage of stemming tobacco for export is considerable; first, your planter pays freight only for tobacco and not stems, and the buyer pays duty only for tobacco—this is the American plan. You should ship your tobacco in hogsheads, very strongly hooped at each end, then place it under a screw.

The man who packs the tobacco in the hogshead, as well as the man who hands the tobacco to the packer, must have his hands slightly oiled with pure oil, lard is best. The man who takes the tobacco from the heap, must hold the bundle in one hand, and draw it through the other so as to press the bundle into a small compass; thus the packer will place the

bundle in the hogshead, the end to the side of the hogshead, and continue packing all round as closely as possible. The second row must be reversed and so on until the hogshead be one-third full, then you must use the screw to get the tobacco down and to keep out all air. If not properly and carefully done, the air will get into the hogshead and the tobacco become mouldy. The pressure of two men on the screw will be sufficient to put into each hogshead *one ton*. The freight on tobacco per pound, from Madras to England, will be only a small item, and I believe it will largely remunerate the planters to export it. But it will be perfectly useless for them to try and compete with the planters, unless they will try to cure their tobacco as I have suggested, keep it clean and of uniform color.

Some time since Mr. Robertson advised the Government to offer prizes for the best grown tobacco. I regret that Government should think the suggestion premature. In every other country prizes are annually given not only for tobacco but all other corps. Why then would it be premature to offer prizes in India?

In my next I will treat on the cultivation and manuring of the sugar-cane, as adopted in South America, where the late Baron Liebog's suggestions are very favourably received and acted on.

Tanjore, 1st June. TOBACCO PLANTER.

—*Madras Athenæum.*

SERICULTURE.

THE EUROPEAN SILK CROP.

SERIOUS fears are entertained of a failure in the European silk crop. The countries which grow silk are Italy, France, and Spain in Europe, and in Asia, China, Japan, India, Asia Minor, and Syria; to which has lately been added America. The American production, however, is so small that it may be left out of account; Asia Minor and Syria were once producers on a very large scale, but have long ceased to be so, and the Spanish crop has also become insignificant. Even France is rapidly falling off in her cultivation of the silkworm. Practically, therefore, manufacturers now depend for their supply on Italy and the Far East. In Europe we may say roughly the Italian crop exceeds the French upon an average nearly four times, while the French exceeds the Spanish in a still greater proportion. We may further illustrate the important position occupied by Italy in this industry by saying that while a good Italian crop is expected to yield about eighty thousand bales, the average import from China to Europe falls short of that amount by about fifteen thousand bales. A failure of the Italian crop means, therefore, in effect a failure of the European supply. Now it is said that not only in Italy, but in France and Spain also the intense frosts of the spring have fatally injured the cocoon. The badness of the weather, moreover, has so checked vegetation, that there are not sufficient leaves for the worms, amongst which there is in consequence very great mortality. And, in addition to all this, it is feared that if heat now sets in, the damage will become irremediable, as the leaves of the mulberry will be dried up altogether To a large extent the excitement that prevails is founded upon mere apprehension, and it is possible that matters may not turn out nearly as badly as it is feared. Much may happen before the harvest. But it is not to be forgotten that the injury done by the severe frost on the night of April 14, 1876, was never repaired. During the two months which followed that disaster, reports were in circulation similar to those now current, but they were set down to the designs of speculators. At the end of June, however, they were found to be correct, and a sudden and extraordinary rise of price was the result. Persons interested in the trade remember all this, and are resolved not to be caught a second time. There has, therefore, been a great deal of speculative buying, and consequently a sharp upward movement of the market during the past fortnight. Yet it does not necessarily follow that the experience of three years ago is about to be repeated. However, without dwelling further on this point, let us take the reports from the silk districts as they reach us; and, while bearing in mind that they may prove to be greatly exaggerated, try to forecast some of the consequences which will ensue, should they turn out to be well founded.

As was to be expected, the statements conflict in a perplexing manner. The correspondent of one credit institution, interested not in silk directly so much as in silver, goes the length of saying that the reports are altogether false, and that the crop, in Italy at least, is going on well. But the great bulk of the information is the other way. In the trade itself the accepted estimate is that one-third of the Italian crop is irreparably damaged. From Lyons the reports are equally unfavourable. If this estimate proves correct, the European supply will fall short by at the least thirty thousand bales. In other words, the average annual import from China would need to be increased fifty per cent. to make up for the loss in Europe. Of course we say this merely by way of illustration. The silks of India and Japan are more like those of Europe than the Chinese, and they would naturally be drawn upon more largely by European manufacturers. All these countries would therefore contribute their quotas; yet, even so, it is not to be expected that they would be able to furnish anything like the full amount. The harvest in the Far East is already completed, and is said to be abundant in quantity and excellent in quality. But the cultivation was adjusted to meet an average demand. The European failure was not, and could not have been foreseen; and consequently means do not exist of supplying this year in full measure the European deficiency, supposing it to occur. Assuming, therefore, that there is not an extraordinary falling-off in the consumption, there must be a very great rise in the prices of the raw material; unless, indeed, there is on hand a great accumulation of old stocks. It would be very interesting to ascertain the amount of the stocks on hand; but unfortunately it is not possible to do so, except for this country. Here we have accurate statistics, but abroad only estimates are to be found, and on such a point estimates are utterly untrustworthy. Apart from questions as to the competence, means of information, and good faith of the persons who frame the estimates, there is this other consideration—that, if there is a desire to force up prices, dealers would naturally return their stocks very much below the truth, for the express purpose of deepening the popular apprehension of scarcity; while on the other hand, buyers anxious to keep down prices, would equally and naturally, state that they are already provided nearly to the extent of their wants. Leaving estimates out of account, then, we find, from Messrs. H. W. Eaton & Sons' last circular, that the stocks in this country sold and unsold, on the 7th of the current month, amounted to 32,521 bales, against 36,342 bales at the corresponding period last year—that is, a decrease of 3,821 bales, or over 10 per cent. If we may assume that the condition of things here is fairly representative, we must conclude that there is no exceptional accumulation of stocks. But a smaller supply now goes further to satisfy the demand than a larger one twelve months ago, because the consumption is considerably less. Although last year there was depression in the trade, marked by falling prices, and although prices at the end of the year were about 20 per cent. lower than in the previous December, the consumption was still not stimulated. If, then, unusually low prices failed to make a market for the manufactured article, it is certain that higher prices would tend to curtail the demand still more. We may safely conclude, therefore, that less than the usual supply of manufactured goods, even at existing prices, is now needed; that consequently manufacturers have no motive to keep up their outturn to the ordinary level, and that, even if there should be no failure, a smaller quantity of the raw material will probably be used up in the approaching season. Of course, should the failure occur, it will send up the price of the raw material; but as dealers will not be able to get an equivalent rise on the manufactured article unless some vagary of fashion unexpectedly comes to their aid, they will reduce their purchases and work their looms and spindles short time, and thus prevent such an increase of prices as was seen three years ago.—*Saturday Review.*

THE EMPRESS-DOWAGER AND SILK CULTURE.

DELICATE and costly, pleasant to wear and grateful to the eye, it is not surprising that silk, deservedly called by its admirers and those who have made their fortunes or derive their livelihood from it, "the noble article," should from the earliest ages and in all countries have been specially protected, both in its production and manufacture, by the most lofty personages. In Japan, where it is universally employed in the clothing of all classes, woollen fabrics being still only in comparatively moderate demand, it has always been regarded by members of the Imperial family with a favour worthy of its illustrious origin. Many are the pretty legends which ascribe to it a supernatural birth. One of these states that a Japanese virgin drew the first silk-worm from her eye-lashes. The other, as related by Mr. Ernest de Bavier, in his valuable work "On Sericulture and the Silk Trade," tells that a daughter of an Indian King, exposed by a cruel step-mother, who cast her to the mercy of the waves in a hollow mulberry tree, was thrown upon the shores of Japan, where, dying, she was transformed into a *lepidopter*. The little princess had first been given to the lions; then to the eagles; then was abandoned upon a barren and desolate island, whence she was rescued by a fisherman in his coracle; and, lastly, was interred alive in the yard of a castle, but came as safely out of this as out of her previous trials. From these four adventures are derived the denominations of the various mutations of the worm:—the periods of the lion, the eagle, the boat and the court-yard.

Historians differ as to the time when sericulture was introduced into Japan. The most generally received opinion is that the industry originated in the year A.D. 259, with the arrival of some Chinese and Corean immigrants. It is pretty well established that, in the fifth century of our era, with the assistance of Corean workmen, manufactures of all kinds, silk included, were largely extended. In 472, Yuriyaku, the then Mikado, decreed the plantation of mulberry trees, and in every possible way encouraged the culture of silk. He ordered that settlers from China and Corea should pay their contributions to the revenue in that article. With so much in its favour, it is not astonishing to find that, by the second half of the sixth century, the production had attained such a development as to be already one of the staple industries of the Empire. Indeed, it is recorded that the profits derived from it caused it to be followed to the detriment of agriculture. In certain parts of the land, rice-growing was so

much neglected that a famine was feared, and the Government deemed it necessary to interpose its authority. In some of the principalities agriculture, instead of being encouraged, was prohibited; and in Satsuma the plebeians were interdicted the employment of sericious stuffs as an article of dress. Some, again, of the territorial princes monopolised the growth and weaving of silk in their dominions, and disposed of the produce of their looms to provide income, enrich their courtiers, or make presents to friendly potentates. Thus hampered, it would appear that the prosperity of the industry declined. Kæmpfer alludes to the importation into Japan, in his day, of silken goods from China, Tonking, and Persia. Mr. de Bavier, quoting Japanese authorities on the subject, states that *modern sericulture only appears to have become general within the last fifty years.*

The members of the now reigning Imperial family, and especially the illustrious ladies the Empress-dowager and the consort of the Mikado, have done their utmost to foster the growth of silk, and to place the manufacture upon a solid, permanent and remunerative basis. On a very recent occasion they testified, in a manner which should certainly have every publicity given to it, to the practical interest they take in the subject. On the 17th instant, Mr. Iwakura, *U-daijin*, and President of the Nobles' Club, called the members of that institution together in the great hall in Iwato Machi, and read to them two documents which had been forwarded to him by the Minister of the Imperial Household. The first was a letter addressed to the latter official, by one of the Empress-dowager's chamberlains, the other a notification to Mr. Iwakura himself from Mr. Tokudaiji, arising out of the intentions expressed by her Majesty.

No. 1.

To Mr. TOKUDAIJI,
Minister of the Household.

Agreeably to the wish of his Majesty the Mikado, and the decree published by his Excellency, Mr. Sanjo, *Daijo Daijin*, her Majesty the Empress Mother has decided to reduce her personal expenses and those of her establishment. She is also desirous to concur in the efforts now making to give greater extension to sericulture, which constitutes one of the most important productions of the country, and one of its principal sources of wealth. Her Majesty has for many years interested herself in the noble industry. She desires that the daughters of the nobility will follow her example, and orders me to make you acquainted with her wishes, in order that you may take the necessary steps to put her intentions into execution.

March, 1879. MAURI KOJI HIROFUSA.

No. II.

To his Excellency Mr. IWAKURA SANEMI,
U-daijin, President of the Nobles' Club.

In accordance with the desire expressed by her Majesty, the Empress Mother, a *magnanerie* has been established in the Imperial palace of Awoyama. Skilful educators will be engaged in the silk-producing provinces to superintend the cultivation. Individual members of noble houses who wish to learn sericulture, can make application to do so at the said establishment up to the 25th instant.

TOKUDAIJI SANENORI,
April 10th, 1879. *Minister of the Imperial Household.*

Having read these documents to his distinguished audience, Mr. Iwakura addressed them to the effect that the silk industry is, beyond dispute, the most important in the country, the product ranking first among the articles of export. Dwelling upon the example and desires of the Empress-dowager, he said that the Imperial lady would not attempt to constrain any one, but would be much pleased to see that her intentions were complied with. The speaker, of his own motion, suggested that elderly persons, who cannot think of learning the sciences, would do well to addict themselves to silk-growing. He remarked that, for the current year, instruction would be confined to practical lessons; but, commencing with next year, the pupils of her Majesty's silk-school may agree to conduct the "education" of the worms in common in their own houses. His Excellency concluded thus:—"I do not doubt that the innovation will have, in the future, the most excellent results. Once in possession of the required knowledge, our families will be able to create for themselves more independent means and larger comforts. As for the capital necessary to those who wish to enter seriously upon the pursuit of sericulture, we will take care to provide the where-withal, as soon as we are definitely informed of the number of persons likely to require assistance." The measure here indicated and instituted is a liberal and a patriotic one. It is hard to calculate the benefits that may be hoped to accrue from it. Apart from the creation of "independent means and larger comforts," the introduction of a useful occupation, requiring the exercise of great care, cleanliness, and a considerable amount of intelligent observation, into the daily life of the young, will do much towards raising the tone of the rising generation, of girls especially. This class, the young ladies of Japan, upon whom the future well-being of the country so largely depends, lead for the most part a monotonous and useless existence. The Empire is not yet sufficiently disorientalized, if we may be permitted the word, to have effected any very great reform in the domestic and social life of the sex. It is not, perhaps, presuming too much to opine that the early life of the generous and imperially minded lady who has devised employment for the pretty fingers of the damsels of her sex's subjects of good families may, in its recollections of ennui and monotony, have been for something in the suggestion of the measure. The addition which the proposed employment is likely to bring to the resources of many homes, where the pinchings of genteel poverty are not unknown, need not be altogether unconsidered. The comforts of many households of good position on the continent of Europe and in the Australian colonies, are notably supplemented by the earnings of the "magnanerie." Her Majesty's scheme has our heartiest sympathy, and we trust that the roll of her silk-school is already as long as the article which we here conclude.—*The Japan Weekly Mail.*

IN reference to our incidental remark a fortnight ago on sericulture in Dharwar as it used to be carried on a few years ago, a correspondent sends us the following:—

"The great advantages of Dharwar over other places in western India are:—1st, an admirable medium climate all the year round; 2nd, a medium rain fall—so that the atmosphere is never too damp or very hot; 3rd, mulberry shrubs grow admirably and never fail; and 4th, you have the monthly silk-worm which thrives well, throws off cocoons eight or nine months in the year, thus giving steady work to the people engaged; 5th, the silk is easily wound off and even though roughly reeled by the hand, produces such beautiful dresses as you have seen. If these advantages are not sufficient, I do not know where you get any thing like them in India. I think to these above points I might add a caution, *viz.*, that when they find the monthly worm doing well, don't breed it with any other, but be content; this indiscriminate crossing has caused the continual failures in sericulture in Southern India."

A WRITER in the *Bulletin de la Société d'Acclimatation de Paris* records the results of a number of experiments with quinine sulphate on diseased silkworms. A commission which reported on this subject in 1859 stated that silkworms treated with quinine or gentian never exhibited the same symptoms of cure observed in others which had taken either mustard or valerian; but M. Christian le Doux, being in ignorance of this statement, has made further experiments, with satisfactory results. Worms suffering from *flacherie* were powdered with quinine, and nearly all recovered in a very short time after the application. Some very bad cases of *pebrine*, with open putrid wounds, were successfully treated in the same manner.—*Gardener's Chronicle.*

IN alluding to the gloomy forecasts of the European silk crop, a home correspondent mentions that "the rain and snow of the never-ending winter have seriously injured the prospects in Italy and France, and now if the heat sets in, it will probably be sudden, so that the mulberry leaves will be no sooner expanded than they will be burned up. Prices are rising in Lyons, and stocks are being withdrawn from sale in large quantities; and the market is rapidly assuming a 'bullish' aspect. On the other hand, although it is full early to speak with more than hesitation, reports from China represent the silk crop as likely to be more than fair. The influence of these provisions on the silver market will sooner or later be considerable. The great demand which arose for China silk three or four years ago, when a similar misfortune befel the European growers, caused a large export of silver to the East, and the price, went up to a famine rate. Within my own personal knowledge fortunes were made in a single season, and one of the best known Eastern banks, by a lucky coup, more than retrieved its previous losses by an indiscreet manager, and has ever since maintained its position."

ADVERTISEMENTS.

Registered No. 182.

THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA: FRIDAY, 1ST AUGUST, 1879. No. 8.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

CORRESPONDENCE.

AGRICULTURE IN IRELAND AND INDIA.

TO THE EDITOR.

SIR,—Last monsoon you noticed with satisfaction the establishment of an Agricultural Improvement Committee at Kaira, and the modest pamphlet issued monthly by the committee.

Both committee and pamphlet still flourish, and I enclose copy of a little paper I am sending to the editor for translation.

The Irish system of National Agricultural Education will repay attention, and if this simple little paper is likely to encourage interest to the subject, pray make use of it.

WHEATHAMPSTEAD,
St. Albans, 18th June 1879.

F. SHEPPARD.
Collector of Kaira.

NOTES.

I have lately been travelling in Ireland and have been interested to observe many points of resemblance between that country and India. I will now refer only to *one* point, the state of agriculture.

Now, while trade and commerce have so increased in the richer countries of Europe, that a considerable proportion of the vast surplus profits have been expended on the *land*, Ireland has enjoyed no such advantage, the petty farmers have, as a rule, little if any more capital than their Indian brethren the average size of the holdings is not larger than that in Guzerat; while the huts in which the mass of the agricultural population live, and the food which they eat, are by no means superior to those of the Kaira cultivator.

Again, the soil is certainly not as productive as your best lands in Nariad, Borend, and Anund, and the cultivators themselves are not more industrious than our own, the consequence of all this is, that Ireland is just as much dependent on good seasons as India is. A single bad season produces distress, a succession of two or three results in famine.

The conditions of agriculture in Ireland being thus not unlike those of some parts of India, it will be interesting to you to know what is being done towards improvement, and I will now tell you what I have lately seen in the course of a tour, undertaken in great measure with a view of studying the subject, and of enquiring how far the measures adopted in Ireland are likely to be useful in India. Ireland is the country of small farmers who could not be expected to afford their sons an expensive education in scientific agriculture, such as is supplied at the National Agricultural Training Institution in Dublin For some years past elementary instruction in agriculture, natural science, &c, has been added to the subjects of study in a limited number of the National Schools, and a certain number of farms and example gardens attached to these institutions.

There are three classes of such schools, and the teachers who qualify themselves for imparting instruction in agriculture, receive special allowances and fees for results. I hope that our little farm at Nariad will in time be as useful as some of those I have visited in Ireland.

You will see that the Irish system is not altogether unlike that lately introduced into Bombay by his Excellency the Governor. It was found, however, in Ireland, that some impetus was required to encourage the farmers to imitate the improved system of tillage carried on in the School Farms, and it was also considered desirable to create a spirit of competition and emulation among the small farmers. A prize system was accordingly introduced Certain centres were selected in each province, and an annual sum for 5 years given for the best cultivated farm of a certain stipulated rental within a radius of 6 or 8 miles of the centre farm.

This system was not introduced without a certain amount of difficulty A popular idea sprang up that it was a plan devised by Government and the landlords for ascertaining the best soils with the view of the enhancement of the rate of such.

You, in Kaira, need be troubled by no such apprehensions. Your assessment is fixed for the thirty years of the survey leases, and improvements effected by the occupant do not render the latter liable to a higher settlement.

The difficulty in Ireland was a grave one, and was not overcome for some time. The system is now working well, however, and I see from the last Indian papers that it has attracted the attention of our friend Mr. Robertson.

We have already offered certain prizes at Nariad which we hope will be of some use to the district. Why should we not have one or two prizes on the same principle as the Irish ones?

Think out the scheme for yourselves. I will tell you, in my next, more about the conditions of the prizes.

F. S.

TEA.

SIR,—From an article in the *Indian Agriculturist* of last issue, it would appear that a writer is of opinion that tea on the Neilgherries will *not* pay. But on the other hand it is cheering to find another gives this assertion a positive denial, and since the same has been good enough to acquaint us with his figures of return of tea per acre, we have no need to be altogether despondent; rather it ought to be the means of stimulating those who may not be doing as well as his neighbour to use all his energy to compete with him. Doubtless the fact of proper management being necessary and particularly on a tea garden, cannot be disputed, hence to ensure success this must be the first step our attention must be drawn to, a liberal outlay, and locality are the next things to be observed. It may be observed, people employed on Rs. 20 and 30 per month on gardens many of whom perhaps have had no previous experience in either culture or manufacture of tea, and should the employer's knowledge not exceed that of the person he employs, what results can possibly be expected? And I dare say it is cases of this kind which have led to people crying down this district; I give an instance:—"If an estate be capable of producing from 250 to 300 lbs. tea per acre, and the same brought so low as to give only 25 to 30 lbs. per acre, what could the cause be attributed to? Bad management of course! Hence it is beyond argument that for tea to pay it must be managed by men of practical experience.

AN INTERESTED PARTY.

THE EFFECTS OF DROUGHT ON GRAIN.

SIR,—The last wheat harvest in these districts has shown a fact worth recording. The grain has been superior to any yield, in size, nutritive qualities, and superiority of its flour. It is curious that beyond a very slight sprinkling of rain at germinating time, the crops suffered from drought, the result was the plant was stunted. At the time of flowering or throwing ears there were two or three general showers, all at once the vitality of the plant was aroused, and the latent energies were thrown into fruition. The local dry measure or *topa*, which is the usual medium of barter in these parts, in previous years gave but 26 *chittacks*; this year the grain of a *topa* weighed 32 *chittacks* or over 23 per cent. more. The grain is also richer in gluten, starch, and phosphates. The outturn of chaff or *bhoosa* was of course poor.

The aspect also of various lands was the more conspicuous as regards the crops during this drought, and ought to have taught a lesson to the observant. Those lands which were near any stream or *nulla bed*, and had at periods received the silt from an overflow of water, brushed up famously after the seasonable rain; but lands which were poor from being over-worked, and receiving no strength, as was to be expected, did not show at all so well.

As the Punjab sub-mountain or rather northern districts are reticulated with hill *nullas*, which carry off rich soils after every shower, what seems easier than to turn this richly charged water, and make it flow gently over the lands and deposit its silt. This can be done by throwing a dry weir over the stream at a sufficient height to divert the waters in parts having favourable levels.

It has been remarked often enough, that Indian *nullas* are dreary enough, with their uninviting aspects of sands, the fact is that they have never been utilised, and they carry away their waters richly laden with soils to the sea. A part of the "local rates" could be most profitably employed in this way. Within any area of 8 square miles in this part a *nulla* by a happy accident has jumped over at every freshet owing to a fall on its bank, the result is that the crops have always been superior, and the silt deposits can be observed in its lamina in the sods thrown up by the plough. This fortuitous flushing of the lands makes the *extra* yield in this small area represent a large money value. The local *vadana* wheat which is so superior and commands a high price is but the product of river-flooded lands and is not a distinct species nor is the Egyptian wheat, as is well known.

W. J. B.

Gujrat, Punjab, 30th June 1879.

INFLUENCE OF FORESTS ON RAINFALL.

I.

SIR,—Ever since the publication of Sir Richard Temple's celebrated minute on forest conservancy in the Deccan, the Indian newspapers have furnished the public with a vast number of articles and letters on a variety of topics connected with forestry in India. But as none of these communications (at least, none that I have seen) pretend to offer a satisfactory explanation of the manner in which the growth of forests tends to influence rainfall—which to India is the most important problem connected with the subject—I venture to ask for space to state very briefly what I believe to be a correct and scientific way of explaining this most interesting point.

The fact that the mean annual temperature of the whole earth is a well recognised constant (*i.e.*, averages the same one year with another), implies that the quantity of heat annually received from the sun is balanced by an equivalent loss of heat through radiation into space. This conclusion, however, natural it may seem, is not really correct, for from recent calculations and experiments of Irish and American *savants*, it appears that the loss of heat from the earth by radiation into space falls considerably short of the amount of solar radiation she receives in the year. Thus it is shown in a paper by Dr. Haughton, Professor of Geology in the University of Dublin, an abstract of which was read before the British Association Meeting last August, that the amount of sun heat annually received by the earth is equal in amount to the heat required to melt a coating of ice 80 feet in thickness all over the globe, and that the mean annual radiation of heat from the whole earth is equivalent to melt a coating of ice only 28½ feet in thickness. There is, therefore, a balance of heat received, equivalent to the melting of 51½ feet of ice, to be accounted for, as the mean temperature of the earth's surface is not increased.

What, then, becomes of this balance of solar radiant energy?—For a balance there is even, after making due provision for the geological work done by the circulation of water, &c.

The only possible scientific answer, "that will hold water," is that this balance of solar energy is converted into—another form of energy—vegetable life, and of course ultimately into animal life.

In support of this conclusion, and also to connect it with the subject under consideration, it may be generally stated that the growth of vegetation is accompanied by a disappearance of heat; for, as every chemist knows, the resolution of a compound (*i. e.*, the separation of its constituents) is invariably accompanied by a reduction of temperature.

And what are the green leaves of the forest continually doing, while under the influence of the radiant energy—emitted by the sun, but resolving, or separating the elements of the carbonic acid gas (storing its carbon and liberating its oxygen) present in the atmosphere, and this chemical decomposition is, like others of its kind, accompanied by a fall of temperature—an absorption of heat.

It, therefore, follows that, in addition to the generally acknowledged physical cooling that takes place at night over a forest (leaf) surface, owing to the great radiating power of its green leaves, there is also a chemical action going on during the day time tending to produce a reduction of temperature over the forest surface. And now, as all meteorologists will admit that the most important condition tending to influence rainfall—to induce a more or less saturated wind to part with its watery vapour—a reduction of temperature* over a large area, I think I may safely conclude that the growth of forests over large areas tends materially to influence rainfall.

I do not, however, believe that the planting of a patch of trees here and there can materially influence the rainfall of the future; but I should, in common with Sir R. Temple and many others, like to see the treeless hills of the Deccan covered with ample forests.

What might not the climate of Poona be were its surrounding hills but clad with forest verdure!

SAMUEL COOKE,

Professor of Geology, &c., Civil Engineering College.

Poona, June 21.

* Thus Mr. Prout says in his Essay on Meteorology:—"It cannot be doubted that rain is in some way connected with change of temperature; the perplexity attending the subject, arises partly from the impossibility in many instances of accounting for the supposed change of temperature." The writer's object has been to indicate a cause or causes for this 'supposed change of temperature,' so far as forests are concerned.

II.

SIR,—In the *Statesman* of the 28th June you have an interesting letter from Mr. Cooke of the Poona Engineering College, on this subject, and I am writing to offer a few remarks on the theory he advances.

As far as I can understand the Professor's theory, it is that vegetation absorbs heat and gives out cold, and hence the influence which trees exert on rainfall; but is this so? Most residents in India have remarked that at night the atmosphere under a grove of trees is much warmer than the air in other places, while in the day it is of course cooler owing to the shade and the draught that always exists under trees, thus, I think, showing that trees give out heat during the night at any rate, whether they do so during the day ought not to be very difficult to find out.

The chief cause of rain in India I take to be the setting in of a cold wind after a warm one—for a cold wind arriving at a warmer climate would lower the temperature and diminish the power of the atmosphere to retain moisture, and anything that tends to obstruct the cold wind would certainly cause a more copious downfall than if it were to have free passage. Is not this the explanation of the action of trees in India?

C. E.

July 5th, 1879.

TREES AND HEALTH.

(To the Editor of "The Englishman.")

SIR,—Ten or twelve years ago there were no trees or hedges in or about Jamalpore; it was then one of the healthiest stations on the plains of India, indeed, cases of sickness were extremely rare in all seasons. Jamalpore is now densely covered with trees, hedges and shrubs, and is one of the most unhealthy stations on the E. I. Railway. Can any of your old Indian worthies supply any information, or data, whereby the quantity of vegetation of this kind may be regulated. The self-elected wiseacres who manage this place seem to think that the nearer we approach the primeval jungle the more we advance in sanitary security.

A. C.

Jamalpore, July 10, 1879.

THE CULTIVATION OF TOBACCO.

(To the Editor of "The Englishman.")

SIR,—I see by your late journals that the culture of tobacco is going ahead in India, but not with very good success, for want of knowing the proper season of seed sowing and transplanting more than anything else. I would advise them to do in future as I have done, and if they do so they will find that the culture of that article will become good and very profitable, and prove of little or no trouble to the cultivator.

The proper time for seed sowing is in the months of May and June so as to have the plants ready for transplan ting by the setting in of the monsoons. In some parts of the country the monsoon sets in in the month of June, and in other parts in July; in the Chutia Nagpore district generally in July. I had seed sown in June, both tobacco and cabbage, and had my cabbage white by October, and the tobacco full-grown and ready for cutting. After so doing, one has only to look to the after-crop, which has been very good.

Owing to certain circumstances, I have not sown any this season. A few years ago I offered the jail department to put 1,000 acres under tobacco for them, the land was then available, but no one took any interest in the matter.

Believe me, tobacco is as simple to grow as is cabbage, but you must know when and how to do it. Two crops in the year can be got, one a good after-crop, so if that would not pay well, I do not know what would.

THOMAS GALLAGHER.

Hazaribagh, July 8, 1879.

LENTILS AND HORSE GRAM.

(To the Editor of "The Madras Athenæum.")

SIR,—Allow me to disabuse the mind of your English correspondent of the belief in the identity of horse gram and lentils. The former is the *Dolichos uniflorus* and the latter, the *Ervum lens* of botanists. Colonel Drury does not mention the lentil among the useful plants of India. It does not appear to be indigenous to, and it is certainly not cultivated in, this Presidency. Horse gram is kidney-shaped, varying in colour from buff to burnt sienna and black. The lentil has the shape of a bi-convex magnifying glass. It is very much bigger in size than horse gram; and when fresh it is of a bright magenta colour. If they differ in these respects, they agree in some others. They are both pulses; and when boiled they not only taste very much alike—a very pleasant taste indeed—but they also have the same appearance. They are not both equally suited for human consumption. A plentiful meal may be made out of lentils, but no one, not even a horse-keeper accustomed to indulge in horse gram, could dine exclusively on this substance, without suffering from severe griping and indigestion. The horse-keepers have to restrain their children from overeating the gram boiled for their charges. In small quantities, horse gram is used by the natives for various culinary purposes. It is one of the nine food substances, *Nava dhaniya*, required for many Hindoo ceremonies. On the whole it does not deserve the contempt or at least the neglect it meets at the hands of Europeans. Let those who can appreciate a strong curry, try gram mulligatawny prepared with gram water and a nice piece of salt fish. If they do, I am sure that many will think this soup by no means to be despised. I humbly commend this dish to the learned disciple of BRILLAT SAVARIN who has contributed his jottings to your valuable paper.

G. H. C.

THE USE OF SAW-DUST AS MANURE.

(To the Editor of the "Journal of Forestry.")

SIR,—In reference to the use of saw-dust for manure, a little addition to the statement of its application may be found in the following extract from "The Epic of a Day," by an "English Yeoman." Rhyme is here made the medium for imparting some scientific facts and processes in agriculture.

> "A chemist proves in language scientific,
> For land that's cropped by sugar-draining beet,
> Sawdust saccharized by acid sulphuric,
> Restores the soil for barley crops or wheat."

The process of using the sulphuric acid is simple enough; the dry saw-dust is spread out thinly in leaden trays, or on hard clayey ground, if there be no lead to make up into shallow trays for the purpose.

The strongest sulphuric acid is poured on the saw-dust from a leaden watering-pot, the acid in the saw-dust is decomposed and becomes saccharized, the fibre of the wood is charred, and the whole forms a black pulp, which is shovelled off ready for use with any dry manure, ash, &c., from the drill or for broad cast sowing.

The simple system of cleansing and utilizing sewage streams by interception and delivery from partially submerged cylinders, has ample exposition in another verse.

The system of intertilling crops, for market garden produce, is urged for general application for suitable crops.

Other farm topics are treated by the "Yeoman" in the same terse and epigrammatic way, which portrays an age of learning woven in a verse. "The Epic of a Day," being mainly a romance of chivalry, forestal beauty is amply delineated.

ANNIE LILLIAN KING.

Norton Cottage, Grantham.

THE OLIVE IN INDIA.

(From a Native Correspondent.)

IT would be a gigantic though not an insurmountable task to ascertain, identify, and arrange into their respective classes and sub-divisions the fauna and flora of such a vast country as India; but it is surprising nevertheless that, even after full two centuries and a half of British occupation, we should remain as it were on the threshold of the enquiry, and, in some cases, ignoran t of even the most ordinary trees, plants, and shrubs. It was only the other day, if I am correctly informed, that India and Burm ah awoke to the fact of the olive being as common as the banian or the mango. Tho ugh without the slightest pretensions to botanical knowledge, I would here venture to ask if the ordinary *Kalatti* of South India is not the Syrian sycamore, if the *Maruda* is not a variety of the oak, and if the *Karuveela (acacia Arabica)* is not closely allied to, if not identical with, the Shittim wood of which Moses constructed the "Ark of the Covenant?"

Since the *Mail* enlightened the Madras public as to the identity of the *iluppei* with the olive, I have been at some trouble to examine it personally, as also to acquaint myself with its distinguishing features properties, and uses, so far as they are known in these parts. Groves of it, either alone or interspersed with the tamarind and such like, may be seen everywhere from the mountains to the sea—and I have witnessed several magnificent specimens so far inland as on the bank of the Tamirapurani near Streevaigun tam; but it is on the elevated regions lying immediately at the foot of the ghauts that the tree attains its greatest height and is seen to the best advantage. Again it is only there that the "labor of the olive" is profitable, seeing that as you go inland, the trees become fewer and fewer, so as to be reckoned of little or no use. In Tinnevelly, from Streevilliputtoor

down to Courtalam, in fact along the whole ridge of the Western ghauts, one may see grove after grove spreading like a silversea; and I shall not be far wrong if, reasoning from anology, I take the whole chain from Bombay to Comorin to be the *habitat* of the olive in India. In order to show that the trees are sufficiently numerous to constitute a new branch of industry or speculation, let me mention that in the two Zemin towns of Veeranam and Veerakaralamputhur alone, there cannot be less than 10,000 trees.

Now for a description of the tree itself. There are two varieties, Iluppei and katiluppei, known respectively to botanists as *Bassia longifola* and *Bassia latifola*; but the former is much more common, and forms the subject of the present paper. The first distinguishing feature is the warts or knobs studding the stem, which gives the tree the appearance of one afflicted with elephantiasis or "Madura foot," though trees in the exuberance of youthful vigour present few of them, one here and one there, and they again neither so large nor so ugly as in their elder brethren. Not only the knobs, but the cracked serrated surface of the bark, is an indication of decrepitude and old age. With respect to height, I have seen trees as tall as fifty or even sixty feet—a fact which at once shows the congeniality of the soil as compared with Europe, seeing that the *Olivea Europa* is said to grow generally to the height of thirty feet only. The branches are numerous and irregular, though not thick-set, and the leaves hardly differ from those of a mango, being oblong in the middle but tapering to either extremity. When tender or fresh-set, they are yellow-green, or rather of the colour of peach leaves, but they soon turn green as they become older; while their stalks (petioles) remain gray or almost white, whatever the age of the leaves. In the matter of flowers, there are few trees in India which are as prodigal of them as the *iluppei*; in fact, the tree at times literally bends under the load of them. In March or April, when the tree is in full blossom, may be seen parties of little folks busy of a morning gathering the flowers in their laps, or swallowing them with the keenest relish; be it mentioned that the ground underneath is thickly strewn over with flowers which the tree casts off. Hanging as they do in graceful festoons, several on one peduncle, or covering the ground as with a mantle of snow, they add greatly to the beauty of the tree—not to mention the sweet sickening fragrance they exhale from a peculiar honey-like substance they contain. In colour they resemble enamelled glass or dirty snow, in shape miniature pine-apples or the globular shades of French lamps. The fruit is oval, but encloses an oblong nut (in some cases two) which in its turn contains a white oleaginous kernel of the same shape. The uses of the tree are manifold. In the first place, it yields timber of the best quality—hard, yellow, close-grained. Near the eastern or main tower of the Streevilliputtur pagoda, there lies flat in a neighbouring street a tremendous beam of *iluppei*, some thirty-five feet long and nearly two feet thick, used occasionally, I am told, as a lever in propelling the temple car. The bark and leaves are used medicinally, while the flowers are eaten on the spot, or stored up for future use, to be roasted or made into curry. I do not know whether natives of these parts distil a kind of arrack from the flowers called "smoky jack" (as OBSERVER says in the *Mail* of the 12th March); but if they do not, it must be from sheer ignorance, and not from scarcity of the tree. The most valuable part of the tree is its fruit, of course. The berries are shaken off the tree when nearly ripe, and then allowed to dry for a reasonable time, when they are peeled by means of a wooden mortar pressed against them with the hand. The subsequent treatment of the kernel is the same with that of other oil-seeds of the country, except that, in the case of the *iluppei*, either straw or bran is thrown into the mill in order to facilitate the extraction of the oil. Then, to make the matter worse, the oil is adulterated with an inferior sort called *Punneinnei* (the produce of a different tree), and the whole palmed off on the public as genuine *iluppei* oil. What with the fermentation the berries undergo, the admixture of foreign substances, and the subsequent adulteration, it is no wonder that the oil should be in bad repute and that it should yield more smoke than light. But it is not difficult to procure it genuine, even as fresh and pure as the imported salad (olive) oil; for most proprietors have always on hand a slender stock of unadulterated oil for their own use, not to mention the fact that if you want the oil pure you have only to *see* that it is pure. Where the oil is pure, it is and may be used for seasoning curry, for frying meat, for anointing wounds or burns, in short, for every purpose for which gingelly or ghee is used. The Rajoos of Rajapalaim submit the oil to a curious process before using it as a substitute for ghee. Dry cow-dung of the requisite quantity and quality is added to the oil, which is then boiled and strained. It is next boiled and strained again, having this time received an addition of chillies and tamarind. The oil thus prepared readily freezes like ghee or cocoanut oil, and is carefully stored away in jars hermetically closed, a little being taken now and then as occasion may require. One word more, and I have done. Taking a quart to be three-eights of the ordinary Tinnevelly seer, we may put down the price of a gallon at one shilling and six pence. I cannot say for certain at present, but, say, the English price of a quart of salad oil is one shilling and six pence; the difference of price then, is as one to four, leaving thus a wide margin for profit should European capitalists turn to the Indian olive as a source of profitable investment. Only prepare the oil as in Spain or Syria, and there is no reason why the olive should not prove here as great a source of wealth as in those countries.

KOTEGHUR NOTES.

SIR,—During the first week we had rain, then hot and dry till the 15th, on the 16th and 17th hard rain, then clear again; on the 24th the summer rains commenced, and were tolerably continuous until the end of the month, the ground has only been moistened to a depth of seven inches. On the 6th there was a fall of snow on the upper range, not descending below 15,000 feet.

The following is a comparative table of the past five seasons:—

1875.	1876.	1877.	1878.	1879.
*0 †8	0 9	0 10	1 7	0 13
Hot and close: especially about even-tide.	Hot, close, and dry. Bright mornings, cloudy afternoons.	Temperate. Crops 20-25 days late in ripening.	Perfect for all agricultural operations: the growing showers were delightful.	The rain, though spread over a greater number of days than in former years, was less in quantity.

* Haily days. † Rainy do.

The wind has generally been from the South or West, thunder and lightning moderate.

The thermometer hung in an open verandah W. aspect, has been 66° in the morning (about 6 A. M.,) and 70° in the evenings (sun-set) lowest 55°, highest 80°.

Since the advent of the summer rains the afternoon haze has disappeared, and with it has gone its accompanying depression of spirits: the days are clear though moist and steamy, still such weather can easily be borne after the preceeding dry heat. The hill-sides have now become beautifully green, though the grass is very short and scanty for the time of the year, due to the late drought. The cattle will now be able to fatten up, and so be fit for their summer and autumn ploughing work; for the last few months they have presented a very miserable appearance.

After a long spell of dry weather, a considerable quantity of dust forms on the surface of ground open and exposed to atmospheric changes,—this—on sloping land—is washed downwards and in its progress buries seedlings of tea-plants, especially those sown *in situ*, so deeply that in many cases they never recover: this may account for some of the numerous vacancies in tea-gardens, yet unaccounted for. Blank patches in the grain fields, on excess land can be accounted for in the same way.

The Jhow *mela*, a religio-social-mercantile gathering of the Hill men, took place on the 24th and 25th (the usual time): this may be called the "opium fair," as large quantities are brought for disposal to *bunniahs* from the plains, many of whom come up for the purpose of making investments in this drug. This opium is much inferior in quality to that of Bengal, and is chiefly consumed in the neighbourhood of the lower hills: the duty is very light in consequence of its inferior quality, preventing any competition with the Bengal kind. The quantity offered for sale this year was less than usual, due to the late drought.

The blossoms of the horse-chestnut tree have departed, and their place has been taken by the young fruit now forming. The wild roses are al gone, but they have been replaced by hosts of other wild flowers, among which may be enumerated the anemonies with their bluish-white petals, the pink and white sibbaldias; lilac buttercups (*anemone discolor*); white lilies of the valley; pure coloured columbines (*aquilegia vulgaris*). The green berries of the berberry (vern. *komashal*) are now forming, next month they will turn to a purple hue. Wild rue is sprouting; likewise the Desmodium tiliafolium (vern. *mús, katti*) whose bark makes a strong rope and paper. The acorns of the spreading-oak (*guercus dilatata*; vern. *moru*) are now forming. Blackberries are ripe, the fruit makes a capital imitation of "raspberry vinegar," by steeping it for three or four days in vinegar, then strain off, add sugar, and boil; the fruit must not be boiled or the result will be a jam! When drinking the "blackberry vinegar" if a pinch of carbonate of soda is added an effervescing drink will be the result: half a wine glass of the "blackberry vinegar" to a tumbler of water is a very good proportion. When in South America in 1872-3 I can recollect gathering blackberries on Christmas eve! Hemp (vern.

bhang, has) is now growing in wild profusion, its roots being strong and long, penetrate deep into the ground and open out the sub-soil in a very perfect manner if cut down before the seed forms, no harm will have occurred to any field in which it may be growing. Balsams are flowering; from the seeds the natives express an oil which they use for cooking and burning. The *arum speciosum* is sprouting and will soon put forth its cobra-like head. Wild thyme in blossom, and with a delightful scent.

The jungle-fowl are now being hatched; while young monauls, kalij, kokias, cheer, &c., are meditating aërial flights, though still under maternal tutelage: young chikore and parrots (green) are able to forage for themselves.

Food grains still continue very high, 8 to 10 seers of flour per rupee and 10 to 12 seers of wheat; and this in spite of the fact, that all the barley harvest and three-fourths of the wheat harvest have been gathered in. The first portion of my wheat has just been threshed out and I have received 9½ fold on my seed sown; this is satisfactory considering the long drought. The barley crop has turned out, very nearly, at my estimate, *viz.*, a thirteen anna crop. The wheat is still in course of harvesting at the higher elevations: the rain will spoil a portion of the crop now standing in the fields, and if it is not quickly threshed out after being cut, it will sprout and thus become spoilt. The villagers have been busy weeding their potatoes—the hill kind (vern. *givian pahariah*); and sowing millets, Indian corn, and pulses on their wheat fields, as they become cleared of their crop: the present seasonable rain gives promise of a bumper outturn of the present sowings of food grains.

The apricot harvest commenced about the middle of the month and is now three-fourths over. This season has produced a small supply due to the hail-storm which occurred on the last day in March, when the fruit trees were very much battered. Apples are scarce and small this year; as I have mentioned, in my earlier notes, would be the case. Next year we hope to have a good crop. Young walnuts are being gathered for pickling. Plums are in abundance and of good quality.

In the garden we have dahlias, heliotrope, white and magenta-hued petunias, lilies, corn-flowers, lupins, bells, zinias, double balsams, mignonette, phlox, and portulaccas, roses, myrtle, with its delicate white blossoms, verbena. Hibiscus coming into flower. Geraniums in fine condition. Convolvulus.

Of vegetables, we have cucumbers, knol khol, cabbages, peas, beans, lettuces, carrots, parsley, &c., tomatoes, gourds, pumpkins—and Jerusalem artichokes, are progressing favourably. Potatoes in blossom.

A neighbour of mine is growing some mammoth pumkin-seeds obtained from Chili in South America. I have been promised a few slices when ready, and I am looking forward to this event, as a slice I hear, weighs about a hundred pounds, and will require at least a couple of coolies to bring it up to the *bungalow*: to enjoy it I shall be obliged to erect a special stage on which to place it, before cutting it up for division amongst the members of my family.

G. P. P.

The Indian Agriculturist.

CALCUTTA, AUGUST 1st, 1879.

A MINISTER OF AGRICULTURE.

THE announcement that the House of Commons has given a vote in favour of the addition to the English Cabinet of a Minister of Commerce and Agriculture, may help the public in this country to realise the retrogressive nature of the step which the Government of India has just taken in abolishing our Revenue, Agriculture, and Commerce Department. The fact is becoming painfully apparent that what has been called the "forward" policy of the Foreign Department means a backward policy in all that concerns the internal interests of the country. We have been squandering our money out-of-doors in harassing our neighbours and fighting for an imaginary prestige, while, as a necessary consequence, we are now sapping and starving the very sources of our revenue at home, and masses of our population are, with increasing difficulty, barely able to find means of subsistence. At the very moment when we were preparing for a war, which, though it has proved comparatively trivial, might have attained to vast dimensions and involved an enormous expenditure, the Government of India was prohibiting Sir George Couper, on grounds of economy, from relaxing the revenue demand on a people dying of hunger by hundreds of thousands. The same policy is still in force. Semi-starvation having been recognised as the normal condition of the million, Government refuses to interfere with their normal condition, leaving them, we presume, to the tender mercy of "natural causes." It is now an understood principle, we believe, that Government will not interfere to alleviate distress, until there is the most unmistakable evidence that people are dying in crowds, and the mortality is becoming a world-wide scandal. Then a stringent system of relief is established which has only the one merit—that it acts somewhat like the principle of natural selection, keeping alive the able-bodied, and allowing the already enfeebled to die off. All this time the people are paying special taxes to provide a surplus for famine relief, but the national exchequer is like the vessels of the Danaïdes; as fast as land-cesses and license-taxes are poured in, subsidies and war charges flow out; and the Government defend themselves against the charge of misappropriating the famine surplus, by triumphantly demonstrating that they have not got such a surplus to misappropriate. Five years ago the principle was laid down, and believed to be established for ever, that sufferers from famine were to be relieved at all costs. That principle is now repudiated and almost forgotten. But while the Government declared itself unable to relieve the distresses of famine at any cost, it almost redeemed its reputation, for a time, by declaring its adhesion to a policy of prosecuting those classes of public works which it believed to be calculated to prevent the recurrence of famines, and make relief, when they should occur, more easy. Now, however, another backward step is taken, and the prosecution of public works is almost suspended. This is the direct result of the ruinous thing falsely called a "forward" policy. The country can now see clearly that the forward foreign policy involves a dangerously retrogressive policy in all that pertains to the well-being of the mass of the people. And nothing, it appears to us, could be more significant of this retrogressive policy than the destruction of the Department of Revenue and Agriculture. It is true that the Department was not so effective as such a Department should be. But its cost was simply nothing compared with that of a "scientific frontier," which is worse than useless, and a trifle compared with the sum which has been relinquished to purchase Tory votes in Lancashire. India has no need of the "scientific frontier," and no need of Tory votes; but the Department of Revenue, Agriculture, and Commerce was of some use to the country, while it constituted a germ which only needed wise statesmanship to develop it into a real Ministry of Agriculture,—the one great want of this Empire. We pointed out lately that 60 per cent. of our population are engaged directly in agriculture, while 20 per cent. more are engaged in occupations dependent upon agriculture; yet it is now decreed that we are not only not to have a Minister of Agriculture, but not even a department which shall make it its special care.

The action now taken by the English House of Commons in the face of the agricultural distress and the depression of trade, ought to make our Indian administrators stop and consider whether *their* way of dealing with similar, and worse distress in this country, is characteristic of wise statesmanship or of the short-sighted folly of penny-wise and pound-foolish economists. Would it not have been more significant of far-sighted statesmanship to have superseded the amateur Department by a real Ministry of Agriculture, than to have abolished it, leaving practically nothing in its place? England, in moving for the creation of such a Minister, is only following at a late hour the example of almost every important State in Europe and America. France has long had her Minister of Agriculture and Commerce, spending nearly 20,000,000 francs per annum. We have not before us at the moment more recent statistics, but it may be interesting to reproduce from the *Agriculturist* some that we published some time ago. Austria has a Minister of Agriculture, and expended for the needs of the Bureau, in 1876, 11,557,470 florins. Besides this Hungary expended under her Minister of Agriculture 5,402,226 dollars in 1875. France expended in this department, in 1876-7, 19,347,100 francs. The revenue of the Prussian Minister of Agriculture for 1876 was about 962,000 dollars; and about 97,459,000 dollars were

expended by the Bureau. Italy has a Ministry of Commerce, and expended on the department, in 1876, the sum of 2,400,000 dollars. Even Roumania, small as it is, and whose people we are apt to look upon as semi-barbarians, expended in 1875 about 1,000,000 dollars by her Ministry of Public Works, Trade, and Agriculture. Brazil has a Ministry of Public Works, Agriculture and Commerce, the estimates for which in 1876-77, was about 8,500,000 dollars. The Dominion of Canada has a Minister of Agriculture. The expenditure for 1874-75 on Arts, Agriculture, and Statistics was 11,935,076 dollars. Belgium has a Director-General of Agriculture and Manufactures. Japan has a Bureau of Agriculture and Industry; Spain an Agricultural Department; Victoria, in Australia, a Department of Lands and Agriculture. India till now had an Agricultural Department, though it had no Agricultural Budget, and the department had to amuse itself with much work of an amateur kind. Great Britain and Russia have hitherto been singular among progressive Powers in their want of a Department of Agriculture. And just at the moment when England is awakening to the necessity for appointing a Minister of Agriculture and Commerce, India, having wasted her substance in carrying on trans-frontier depredations, is abolishing even the semblance of an Agricultural Department which she possessed.

These facts appear to show sufficiently how ruinously retrogressive the present administration of India has become. *Quem Deus vult perdere, prius dementat.* Given over to strong delusions about a phantom advance of Russia, we have rushed about wildly beating the air, and scattering our resources in the Afghan valleys. And now we are reduced to so great shifts to make ends meet at home, that we are obliged to travel on the very opposite direction to that which every progressive country in the world is taking. The present Government of India will be remembered as the Government which gave us the scientific frontier, stopped public works, and abolished the Agricultural Department.

We have previously remarked on the suddenness with which the work of destruction had been carried out, without, apparently, any deliberate discussion of the proposal, and certainly without allowing due opportunity for public opinion in this country and England to express itself on the subject. We have pointed out that the creation of a Department of Agriculture and Commerce was not the mere freak of a Viceroy, or a member of the Government, as its abolition appears to be. The impulse came originally from England. Parliament had taken some interest in the matter, though Parliamentary interest in all Indian subjects was then but languid. The Secretary of State had it for many months under consideration. It was the subject of a prolonged correspondence between the two Governments. It was closely argued in the Viceroy's Council, and while the reasons against the proposal were as forcibly put as they could have been by Sir Richard Temple and Sir Henry Durand, the overwhelming weight of argument was on the side of Lord Mayo, Sir John Strachey, Sir James Stephen, and Lord Sandhurst, all of whom strongly supported the proposal. There seems to be a singular contrast between the long deliberation and full discussion which preceded the inauguration of the Department, and the haste and want of deliberation with which it has been abolished. It is no doubt much easier to destroy than to create. But it is not the work of wise men to spend years in building up an edifice only to kick it down when their money is spent and the whim changes. We hope the matter will attract Parliamentary attention and criticism, and that we may see not only a Department of Agriculture reorganised, but a real Minister put at its head.

IMPROVED CULTIVATION.

I.

TWO characteristics must appertain to any improvements that may be attempted in cultivation of cereals in India, and these are (1) they must not wander far from the old patriarchal methods which have been in use from time immemorial, and (2) they must be cheap,—we do not mean cheap relatively to results, but cheap relatively to existing systems. Failing these two qualities, no improving scheme has a shadow of a chance of adoption, and this not altogether on account of the excessive conservativeness of the ryot, but largely on account of his absolute poverty.

In a late number we referred to a trial of several new ploughs that had been made in the North-Western Provinces under the auspices of the Department of Agriculture and Commerce, and where the whole question seemed really to turn on the weight and cost of the ploughs tried. After several trials, an American plough was altered in various ways, until the weight was reduced to eighteen seers, and the cost to Rs. 8-8. This plough did fair work, as every allowance had to be made for the class of cattle which were to drag it. We think a much better way of improving the native plough would have been to take a common plough and so alter it as to effect improvement. The ryot would not then be dealing with a foreign article, and our attention has lately been directed to an improvement of this very kind, which seems to us a success. It is called "Jones' Improved Ryot Plough." On writing to Mr. Jones for a description of this plough, he very courteously sent one for our inspection. It is simply then a common native plough, the wood-work of which is made a shade stronger and heavier than usual, in view of the greater depth of work expected from the instrument. To this native frame work are added the following improvements. In the native plough, the mould-board is light, and is tipped with iron, so that no particular sort of furrow is the result, a scratch is simply made, with the earth thrown up on either side. In the case of the new instrument, this mould-board is heavy and is faced with an iron scoop, which makes a proper furrow and throws the soil all on one side. The tip to the depth of 4½ inches is of steel, this to resist the efforts of the plough in going deep into the soil; the plate is one-eighth of an inch thick; the whole workmanship is well within the range of a village smith's powers, and this we consider a very great advantage. The coulter of the native plough is a piece of square one-inch iron, with a sharp tip at the bottom. This is fixed close in front of the mould-board point. In the new plough the coulter is more of a knife-like shape, and by a couple of nuts and bolts can be placed at any distance from the mould-board, and at any angle.

The whole affair weighs but 14½ seers, and costs at Cawnpore Rs. 5-8. The native plough of Bengal weighs not much less, so that while it is certainly heavier than the plough of Upper India, at any rate it is not too heavy to prevent the ryot from carrying it on his shoulder to his fields. In the "Guide to the Saidapet Farm," just to hand, we find the "ordinary native plough of Madras" to be 32lbs. and 36lbs., whereas the several adaptations of light English and American ploughs weighed from 34lbs. to 92lbs. This new plough therefore, occupies a favourable place as to weight. We should be glad to learn how it works, as from a careful inspection of it we imagine it must do its work thoroughly. Doubtless a light English or American plough would do better work, but we must bear in mind the weakness of the average bullock as compared with the plough horse at home.

The ryot wants more manure. This is one of the crying wants of Indian agriculture, and it is one that will not be mended, till the Forest Department supplies the villager with wood for fuel. These poor people are not prejudiced in favour of *oopla* as fuel, and use it simply because they cannot get anything else. Their fields may go without manure, but they must have their food cooked, and we know from what we have seen in various parts of the country, that where the villager can get wood for burning, he utilizes all his cowdung as manure. A better and a cheaper system of irrigation is wanted as well, the ryot in many cases cannot afford to pay the canal rates for water-supply, and besides it frequently happens that the canal water fails at the very time he wants it most. We think a system of *pucka* wells for this purpose would be the best, *cutcha* wells are of little use, and are more expensive in the long run than *pucka* ones. These latter could be made to the required depth at an average of Rs 350 each, and as one well would suffice for ten acres, the sum of Rs. 35 would be invested per acre. The interest on this amount at 4 per cent. per annum would be say Rs. 1-6-5, and this is less than is usually paid for irrigation. The drawing of the water by bullocks does not in reality cost much, as while this work is in progress, there is no ploughing, and the bullocks are comparatively idle. From the last report on the *kharif* operations in the North Western Provinces, we find that the canal water was used on 660,926 acres, and that the revenue was Rs. 18,56,440. This represents a charge of Rs. 2-12-11 per acre *for the kharif crop only.*

The introduction of a superior class of seed should not be overlooked. For generations the same seed has been used without any attempt made to change it. The ryot gathers in his crop, and lays aside what is required to keep him till next harvest time, he also puts to one side the *bunniah's* claim, and a sufficient quantity to sow next season, and the chances are that this seed will be sown in the very same field on which it was raised.

An effort might be made to introduce a system of interchanging seed. In some districts the grain usually grown is very superior, as we understand the Kurnal wheat is. Why cannot seed from such districts be sent over the whole land.

The cattle too must be improved, and while this seems rather difficult of accomplishment, it is really not so. Let the Government provide half-bred English bulls for each district, and the improvement of the cattle is only a question of time. It is of no use however for the present system to be continued. In one district of the North-West there are two—and only two—very fine half-bred English bulls, sent for the express purpose of improving the class of cattle, but what is the use of this, when there are also in this district several thousand bulls of the common scraggy country breed roaming at large with the cattle. The proper way is for Government to raise young half-bred cattle on a large scale, and supply one district at a time with them. When a district is well furnished in this way let all the common bulls be castrated as they grow up, and a change for the better will soon be perceived.

All these changes will require funds, and we shall return to that part of the subject in our next issue.

MINERAL PLANT-FOODS.

THE special objects of agriculture are the production of certain parts of plants, tubers, roots, leaves, stems, seeds, &c., and vegetable substances generally, that may be used as food for man or animals, or that may be employed in arts and manufactures, this at the least possible outlay of time, labour and material, and with the greatest possible profit. It follows from this that the plants so cultivated must be raised from seed, which experience has proved to be healthiest and most productive. The *purity* and *fertility* of the seed (two very different things) must be tested before sowing, as far as possible proper soil must be chosen, that is, the soil must contain substances such as phosphoric acid, potash, and ammonia or nitrogen in some form, without which the plant would die or prove unprofitable. Where these substances are wanting or deficient in the soil, they must be supplied by manure, either natural or artificial. Due attention must be had to the rotation of crops. The soil must be mechanically manipulated to fit it for the reception of seed, and to free it from weeds, and as far as possible from insects injurious to the crop. In addition to this, the raising and feeding of stock is a most important part of agriculture, and it should be added that all these objects are to be effected without impairing the fertility of the soil.

The rational theory of agriculture which practice has clearly confirmed, is, give to plants the substances *essential* to their growth and full nutrition; and hold back as far as possible those substances not necessary for one crop, in order that they may be ready in the soil at the proper time, to feed a crop that most stands in need of them. No one would think of adding carbon to the soil, because this is supplied in abundance by the carbon—dioxide of the air. Oxygen is also largely derived from the air, hydrogen from the water absorbed, and nitrogen from the ammonia of the atmosphere. Potash, soda, lime, phosphorous, alumina, silica, and the other mineral constituents of plants are found in more or less abundance in all fertile soils; and are derived chiefly from the disintegration of the rocks which originally formed the soil; and from the continual *disintegration of the stones* and smaller particles of the soil by atmospheric and other agencies.

Phosphorous is the most important of all the minerals used by plants as food. It is present in the ash of plants in very variable quantities, straws, stems, and leaves contain it in least abundance, but it is very abundant in the seeds of all cultivated plants. In cereals it constitutes nearly one-half the whole mineral constituents. The bones of animals are composed chiefly of phosphate and carbonate of lime. The animals bred on a farm thus carry off from the soil large quantities of this substance; not only in their bones, but in the milk consumed off the farm; and as the richest soils do not contain it in greater quantities than about half per cent., the limit is sooner or later reached, beyond which deterioration of the land sets in. It is found impossible to do much more than produce a barely paying crop, and even it is subject to blight or disease of some sort, without returning to the land the phosphorous carried away from it in such quantities. The application of phosphates to the soil has been followed by the most marked effects. At the beginning of this century, the bones applied to the pasture lands of Cheshire increased the rents by about two-thirds.

Potash next to phosphorous ranks highest in importance as a plant food. About fifty per cent. of the ash of plants, roots and tubers, consists of potash. The haulm of the potato and the leaves of many trees, the beech for instance, contain it in large quantities, rarely falling below twenty per cent. Potash is the most abundant ash constituent of wheat, beans, indeed all leguminous plants, turnips and potatoes, after silica it bulks largest in hay and straw. The importance of potash as an ash constituent of plants and consequently as an essentially necessary plant food has not probably been as generally realized as it might have been. The fact that much of the potash extracted from the soil by plants is as a rule returned to it as in the case of the haulm of the potato, the straw used for litter, and the *dejecta* of stock, either finding their way to the dung heap or being scattered over the land, has partly rendered the imperative necessity for and value of potash less apparent. The true reason why no wise farmer will sell his straw off his land is, that it contains large quantities of potash and silica in an active condition, that are again and again returned to the soil to build up succeeding crops of the various kinds indicated. If straw, hay, turnips, beans and leguminous plants generally are sold off the land and no compensating process arranged for, and by which potash in an available form may be supplied to the soil, then disease and failure of crops must be the natural result.

Soda is a highly essential food for all cruciferous plants, (turnips, cabbage, rape, &c.); in most other plants it can be replaced by potash.

Lime:—The proportion of lime varies from one to forty per cent. in the ash. The seeds of cereals contain about one per cent. It is present in the leaves of some plants, such as the artichoke: all leguminous plants contain it.

Magnesia is generally found in small quantities. It is largest in grains, sometimes as high as from 12 to 13 per cent. in the ash of plants, and falling sometimes as low as 2 to 4. No ash constituent, however small, can be regarded as insignificant.

Silica is a most important constituent of all soils, and is notably present in the ash of cereals. In combination with *alumina* it forms the greater bulk of all *clay* soils; and in union with the alkalies, potash, soda, and ammonia it forms a highly valuable series of compounds known as *double silicates*. The value of the action of lime when applied to the soil, especially in the case of clay lands consists in this, that a series of double silicates are formed which are of the highest importance to the agriculturist. By the application of lime to clay lands double silicates of alumina and lime are formed. In the presence of soda the lime is set free, and double silicates of alumina and soda are formed. If potash exists in the soil then silicates of alumina and potash are produced, and these silicates are again broken up in presence of ammonia; the potash being set free, and silicates of alumina and ammonia are formed. This series of changes cannot however be supposed to take place in the soil with the same precision and entirety as it may probably be able to exhibit it in the laboratory, the process is in all likelihood a gradual one; but the fact that these silicates brought into contact with air have the power of absorbing ammonia; and that their formation may be set up in the soil by the judicious application of lime are facts of no ordinary importance and have probably not yet been fully realized by the practical agriculturist. The three substances which are of paramount importance in agriculture, and about which the agriculturist should unceasingly interest himself are phosphorous, potash and nitrogen. The other constituents of plants are usually present in abundance in all fertile soils, or are supplied in the various manures laid on with the crops; but soils from which

these are absent or in which faint traces only are to be found are invariably sterile.

Nitrates of all kinds, and ammonia in every combination are valuable only because of the nitrogen they contain.

SELECTION AND CROSS-FERTILIZATION OF FARM CROPS.

IN all crops grown chiefly for the market value of their seeds, we may say in *every* crop grown by the agriculturist it is a matter of considerable importance commercially, as well as affording an excellent field for observation and experiment, that he should acquaint himself not only with the various methods over at work in nature by means of which flowers are fertilized, but also that he should realise the great results that may be attained by careful selection and cross-fertilization. It is only recently that the relation of insects to flowers has begun to engage the attention of naturalists. As early as 1793 there appeared in Germany a notable work by C. K. Sprengel, "The Secret of Nature Displayed" in which the intimate relation that exists between insects and flowers was for the first time pointed out. His attention was first directed to this subject by observing a number of delicate hairs in the corolla of the wood geranium (*Geranium Sylvaticum*), and believing that the wise author of nature could not have created even a hair in vain, he endeavoured to discover their use, and ultimately came to the conclusion that they were intended to protect the honey from rain. Many other flowers were examined by Sprengel and he concluded that several points in their structure could only be explained by their relation to insects. Until the publication of Darwin's "Origin of Species" in 1859, the dominant idea among naturalists was, that each species whether of plant or animal, came fresh from the hand of the Creator, the outcome of a distinct creative act; and that every departure from what was postulated as the type, was a malformation, a monstrosity, a violence done to the perfect form originally created by the Author of nature. It may be fresh in the memories of some of our readers with what unmanly howling, what unreasoning declamation the doctrines of "The Origin of Species" were received in certain quarters, though now-a-days the origin of species by natural selection is admitted to convey a much higher ideal of creative power, and to be one of the most fruitful and far-reaching theories propounded since the systematic study and development of the Physical Sciences begun. Sir John Lubbock believes that it was this low idea of creative power, prevalent in Sprengel's, day, and to the era of "The Origin of Species" that prevented naturalists who followed Sprengel in the same field, and even Sprengel himself, from "perceiving the real significance of the facts discovered." In 1857 Charles Darwin published a short pap. on the fertilization of the kidney bean. In 1862 appeared his book "On the Contrivances by which British and Foreign Orchids are Fertilized by Insects"; and in 1876 "The Effects of Cross and Self-fertilization in the Vegetable Kingdom." Since the appearance of Darwin's book on orchids many others have been published on the fertilization of flowers, the most notable being that of Herman Müller 1873. Darwin says that "the value of H. Müller's book can hardly be over-estimated, and it is much to be desired that it should be translated into English." His work differs from that of all others in specifying what kinds of insects, as far as is known, visit the flowers of each species. In 1875 Sir John Lubbock gave a summary of the subject in his "British Wild Flowers Considered in Relation to Insects."

In addition to the works already enumerated, the names of Hildebrand, Delpino, Axell, and others may be mentioned as workers in the same field, besides shorter papers scattered over magazines and "transactions"; so that the literature of the subject is not altogether insignificant.

When flowers are spoken of, what is popularly meant is a more or less conspicuous coloured structure which appears before the plant runs to seed or fruit. The coloured portions of flowers, the calix and corolla, in reality, however, are the mere envelopes of the real flower which lies within them, and consists essentially of one or more stamens and pistils. It is the pollen grains, shed from the anthers of the stamens, and falling on the adhesive surface of the stigma the end of the pistil that produce fertilization. Once this corolla) shrivel up and fall away, and the pistil swells and grows in bulk, till it assumes the form of the perfect infructescence. There are four well known ways in which flowers are fertilized :

1st. The parts are so arranged that each flower fertilizes itself naturally.

2nd. In some cases the pollen is carried by the wind, willows, and grasses.

3rd. In others, birds carry the pollen, crows, minas and squirrels may be seen at work on the red flowers of the cotton tree (*Bombax.*)

4th. In the great majority of instances, fertilization is effected by insects.

It is in one or other of these ways that all plants are fertilized; and the great fact enunciated by Darwin and brought clearly into notice by him, is, that the importance of insects to flowers does not consist in their transferring the pollen from the stamens to the pistil of the *same* flower (self-fertilization) but from the stamens of one flower to the pistil of another on the same or a different plant (cross-fertilization).

Insects visit flowers for food, attracted by the scent and colors of the flower, and guided to the spot in the flower where the nectar is secreted, by the smell of the honey, the conspicuous colors, and the lines and markings on the floral envelope. Ants, moths, bees, and butterflies of all kinds are continually at work searching for food in and about flowers. In this way various parts of their bodies come in contact with the stamens and are dusted over with the fine pollen grains shed by the anthers, and so carried by the insects from flower to flower, and in their efforts to reach the nectar secreted at the bottom of the corolla tube or at the base of the anthers, the pollen is deposited on the stigmas and so cross-fertilization is accomplished.

This shortly stated, is the substance of the whole matter, so far as insects are concerned in cross-fertilization. It is a matter of no ordinary importance to the agriculturist to acquaint himself with the species of insects that frequent his fields and fertilize his crops. It is a matter of no ordinary importance to know some of the conditions of their existence, for on their life depends in some measure the fertility and weight of his crops. We believe that to this subject of the fertilizing of flowers, probably too little, indeed scarcely any attention has, as yet, been paid by the agriculturist. A good deal has been written about the insects injurious to crops, but a great deal more requires yet to be observed and recorded regarding the insects which are beneficial to crops. Plagues of locusts do not come by chance, various kinds of insects do not appear or disappear without leaving in their train consequences of a more or less marked character. It is only when these consequences assume the form of palpable disaster that the bulk of men take any notice of them. Whatever at any time tends to produce a disturbance of the relative balance of power among insect life may be expected to produce disaster to the agriculturist in the long run. If by any means, meteorological, climatic, or what for want of a better name we may call biological, (that is, the introduction of some plant, insect, or animal, which disturbs the relation of the link of life in any district), any one species of insect is exterminated or decreased in number, or any species is unduly increased in strength or number, then it follows that disturbance of a very grave character will make itself apparent in the long run. As an illustration of our meaning take this from Darwin :— There is only one species of bee with a proboscis long enough to fertilize red clover; when this bee dies out red clover will go with it; field mice rob the nest of this bee and destroy its young, cats kill field mice but as a rule do not eat them. Old maids are supposed to be conservators of cats. From old maids to red clover there is a long way; but they are linked together in a logical sequence of irresistable cause and effect.

Farm crops of all sorts, and for whatever purpose raised, will fully repay intelligent observation on the times of their flowering and the conditions of their fertility. It is in this direction that great progress may be made, in securing by cross-fertilization a race of plants possessing characteristics which by care and judicious selection of seeds may add considerably to the weight and paying qualities of crops. It must be apparent to all who have given topics of this nature any thought, that whatever improvements may have been effected in the fertility and vitality of seeds, and the bulk and weight of

of the likeliest plants. What we advocate is a closer and more intimate acquaintance with, and a careful and systematic study of, the whole conditions implied in the fertilization of crops. This it seems to us is a matter that has not yet received that attention which it might, and which in conjunction with an intelligent acquaintance with the treatment of the crops, would add considerably to the profits of the farmer and to the wealth of nations. We believe that it is not sufficiently realized that while the general climatic conditions of a district are possessed of features in common that justify their being classed together and spoken of as universal within the district; nevertheless there are many physical and natural conditions peculiar to much land in the district which in many cases materially effect for better or worse the prevailing climatic conditions. There can we think be no doubt that it is varying conditions of this sort, that help to give peculiar advantages to certain plants and animals over others in the same locality; and distinctive breeds of cattle and varieties of plants by long acclimatizing to the same few square miles or even the same farm, will in the long run, with judicious and sensible treatment, develop qualities and capacities which will distance all other competitors.

Breeders of animals of all sorts whether for sport or profit are careful in their selection of animals to breed from; and are justly proud of the pedigree of their stock. The same vigilance and skill, exercised in the selection and cross-fertilizing of plants, will ultimately lead to the production of races of plants distinguished by those qualities which the selector may desire to render permanent. The whole subject, in its application to farm crops, deserves the closest attention of agriculturists, and it will amply repay intelligent observation and experiment.

EDITORIAL NOTES.

THE Report on the Revenue Administration of the Punjab and its dependencies of 1877-8, has reached us, and is as a whole a record of onward progress.

It is a pity that some system could not be adopted, whereby the ryot would change his custom, of only using canal water when his crops are on the verge of ruin.

He seems to hold on to see whether rain will ultimately come, and when he has given up hope, and his crops are scorched, he reluctantly applies for canal water, is it the cost that makes them so unwilling to spend a little in this way? The rate does not seem high, as we find that the average charge for canal water was Rs. 1-3-8 per acre, and that does not seem a large sum to spend in order to secure a good crop. Only other two reasons remain, want of enterprise and poverty, and we suspect both are to be debited with blame in the matter.

JUDICIOUS advances are being made to ryots for pressing purposes such as making *cutcha* wells during very dry weather, the amount so, advanced during the year under review being Rs. 100,218, a very small sum, to the Punjab Government, but it would doubtless be of great service to the poor ryot. These advances seem on the whole, to be recovered punctually, a little more of this all over the land might help to remove the ryot from the grasping clutches of the *bunneah*.

THE rainfall in July and August 1877, averaged over ten divisions 4·06 inches, while the previous years averaged 17·61; this accounts for the failure in the autumn crops.

THE produce of the land is carefully gone into, and while it seems low compared with English outturns, it is certainly good from an Indian point of view. The quantity produced per acre is as follows:—

Barley	788 lbs.
Cotton	85 „
Gram	688 „
Indian Corn	959 „
Rice	682 „
Sugar (refined)	409 „
Tobacco	788 „
Wheat	677 „

At Sirsa the yield of wheat is only 197 lbs., while at Kurnal it is 1,600 lbs. The above table being averages.

THE deaths of cattle during the year have been very heavy, and the report says "has made a serious impression on the wealth and comfort of the people."

OF land sales during the year, 66 per cent. passed to agriculturists, while 34 per cent. went to the non-agricultural classes.

A WESTERN contemporary says:—What will H. E. Sir Richard Temple, and our Indian Foresters say to the following extract from the *Times*?—"The fact seems to be that no individual efforts of artificial irrigation, can at once correct the evil of an atmosphere drained of all natural moisture by the ruthless destruction of its woods. Madrid was, centuries ago, a royal or imperial hunting box, in the midst of a vast growth of primeval timber. The trees are gone, and with them the vitality of the soil; and it would take no less than all the care now bestowed on the Buen Retiro, the Casa de Campo, and other royal park to restore to the whole region that freshness and verdure, that blissful temperature, which it received from the Creator's hands." This points to replanting on a very extensive scale, an idea we hope to see carried out soon.

SUNDRY Forest reports have reached us, through the courtesy of the Department of Revenue, Agriculture and Commerce, and we have much pleasure in observing that increased attention is now given to the more practical portion of work, such as prevention of fires. The damage done by these fires is incalculable, young saplings are utterly ruined, and larger trees have their bark destroyed to a certain extent, which frequenly ends in the tree dying, and thereby the labour of years is lost. Some of these fires are accidental, but the great majority are intentional. They arise from two causes:—*First*, villagers setting fire to the hard, dry, and wiry grass that grows to such luxuriance in the partial shade of these forests, that thereby the young tender grass may be encouraged, and they get food for their cattle. The villagers cares nothing by the damage done to the forest, *that* is not his business. This system of cattle grazing is a mistake we think. For a few annas a year, a ryot is at liberty to graze a cow in the forest, and while the Department makes pence by the system, it loses pounds. The second cause of intentional fires is the custom of *jhooming* resorted to by many of the hill tribes. The custom is to burn down a portion of jungle, plough up the land, take 2 or 3 crops off the virgin soil, and move elsewhere to repeat the process, a more suicidal process could hardly be found.

WE see too that attention is being given to fuel. This is right, so long as the departmental servants cut and collect it, but if the purchaser gets a *purwana*, and is allowed to collect for himself, great destruction will follow. This is the almost universal custom in the North-Western Provinces.

Efforts are being made in the Punjab to cultivate several new timbers such as:—

Acacia Dealbata
do Melanoxylon
Eucalyptus Rostrata
do Resinifera
do Longifolia and the Cork tree

All of which are doing fairly well. English trees are also being tried, as the chesnut, oak, beech, mountain ash, elm, and some varieties of the larch from Scotland, and good reports come in from all sides.

IN Assam, fires and visits from wild elephants are so prevalent, that a brigade called the "Protective Establishment" has been found necessary. It consists of Forest Rangers and Guards, and has been doing good service in the way of prevention.

There they are experimenting very extensively with India rubber *Ficus Elastica*, and we find that about 600 acres have been planted out with this valuable tree.

IN British Burmah attention has been more given to planting out young teak trees, and this is being done no sooner than it was wanted, as the teak of British Burmah seems to be a thing of the past. The whole subject of forest preservation and renewal, requires instant attention.

COLONEL BEDDOME, Conservator of Forests, Madras, has reported to his Government that the second batch of mahogany seed supplied

to him, has, like the first, utterly failed to germinate. This is to be regretted, more for the time and labour lost then for the value of the seed or its prospective produce. Doubtless it is advisable to introduce valuable timbers from various localities, but we question the benefit to be gained from the mahogany tree. It is a very slow grower, and while, for the purposes of furniture, we have the toon, *(Cedrela toona)*, sissoo, *(Dalbergia sissoo)* and teak, *(Tectona grandis)* all more or less suited for this purpose, and all comparatively fast growers, we hardly think it advisable to waste valuable time over the other class of timbers. Still we see the Government of Madras have asked the Secretary of State for a third supply.

Dr. Ribbentrop, of the Forest Department, has been detained in England for a month beyond the time at which his leave expired, in order to afford him an opportunity of conferring with Mr. ~~Thos. Routledge on the subject of the~~ preparation of paper from bamboo stems, a branch of industry to which much importance is now attached.

The actual proceeds of this year's pearl fishery in Ceylon have been far in excess of what had been anticipated. Instead of about three millions of oysters there were seven millions fished, and it was believed that but for the frequent interruption by weather, two millions more might have been lifted. The amount realised by sales of oysters was Rs. 60,000, and it is believed that the pearls in possession of Government are worth Rs. 40,000.

In well kept lawns, weeds, such as dock, plantain, daisies, dandelions, and others that will spring up eventually if let alone, are not present. Whenever, therefore, they are found, they should be cut some distance below ground, with a thin chisel made for the purpose, and the weeds carried off the lawn. This takes but little time, unless the lawn be large, and here the owner is supposed to be able to gratify his taste for this most attractive of the surroundings of the homestead.

It has been recommended to salt patches of weeds. This, however, is not advisable, since it first kills the grass near, with the weeds, and afterwards produces dark spots on the lawn from the increased luxuriance of the grass about where the salt has been placed. For a lawn such as we have described, or one not to be often and closely mown, the following grasses are suitable: sweet-scented vernal, one pound; meadow fescue, meadow foxtail, hard and sheep's fescue, and rough-stalked meadow grass, each 2 lbs., 4 lbs. of white clover, and 6 lbs. of red. This will give 31 lbs. as mixed, a fair sowing per acre. To this you may add 1 lb. of yellow oat grass, and 2 lbs. of perennial red clover, it you like. It will not be too much. Forty pounds per acre is often used and with the best results, since a thick sward is the beauty of the lawn, and thin sowing always leaves bare places which, if not occupied by weeds, never fill perfectly.

In view of the impetus which the partial—almost total—failure of the European silk crop has given to the China and Japan trade, and ought to give to that of India, we have devoted more space than usual to that branch, and we trust that the Indian villager will be taught to take advantage of the favourable position he now finds himself in, and that, this temporary demand over, he will continue to improve his manufactures, and to increase the quantity he turns out, so that he may take the place, the climate of India intended he should occupy with reference to this branch of industry.

With reference to the letter of An Interested Party to be found elsewhere, we think there can be no doubt but that tea will pay in the Neilgherries. The climate is temperate, and the rain-fall fair. At the same time we think it would be much better for capitalists to invest their money on land at a lower level, if they *do* invest in tea. It must be remembered that the tea plant luxuriates in a moist steamy atmosphere.

Mr. Robertson, the head of the Agricultural Department has prepared an Agricultural Primer, which the Governor in Council has accepted as a suitable text-book for schools in this presidency, and directed that 1,500 copies be struck off at the Government Press for sale. The Primer will be translated into Tamil and Telegu and published simultaneously with the English edition.

Mr. Thomas, acting second member of the Madras Board of Revenue, recommends the common cactus (*opuntia*), popularly known as Adam's needle, as a shelter to young trees when in their seedling stage, and suggests, that when it is decided to plant trees in waste land, instead of raising these seedlings in nurseries, and transplanting them afterwards in the open, the seeds should at once be sown *in situ* with three or four cactus seeds round each, the theory being that the cactus will grow up quickly and form an invulnerable hedge around the young sapling, protecting it from storms, and from cattle, which are fond of nibbling at the young shoots. The idea does not seem a bad one, but it seems to us, that a great difficulty will subsequently be experienced in getting rid of the cactus when its protecting care is no longer needed, and when it would be a nuisance. It is an astonishing plant for spreading, and in four or five years, would form an impenetrable jungle, offering the greatest possible obstacles to its eradication.

It is said that "analysis has discovered that 508lbs. of organic matter is removed by a crop of corn from an acre of ground." Now, will your writers on science inform us practical farmers whether the analysis was of the crop or the soil; if of the latter, how are we to know that it was not absorbed from some other source, say from water; and if the stalks which are said to contain 400lbs. of inorganic matter, are cut up and ploughed under, how are we to know that this 400lbs. is returned to the soil; and what is the difference between cutting off the corn stalks in the fall and allowing them to stand all winter. We know that there is a difference and that by allowing them to stand until all moisture disappears, the soil is less exhausted than when cut off while full of sap.

If it be true that 508lbs. of organic matter is removed from an acre of land annually in the production of a crop of corn, and in ten years 5080lbs. is removed with the crops, and fully as much more is removed by the washings of the rain-falls, will our scientific farmers show us how it is that a crop of red clover will in three years make the land more productive than it ever was. There is a field near us that was so much exhausted three years ago, that the crops were very poor, since which it has been in clover which during the present season has advanced so far as to begin to bloom and now during the last few days has been ploughed less than 8 inches deep, and having known the said land ever since it produced its first crop, we do not hesitate to say that it can be made to produce more corn now than ever before and more than can be produced on any land by ploughing 16 inches.—By W. B. Smith, *Franklin Co., Mo.*

In reading over W. B. Smith's "Some Questions about Corn Stalks" we were forcibly reminded of the opening of one of Bacon's essays, that on Truth. Here it is, "What is truth?" said jesting Pilate, and paused not for a reply. The spirit of the question, it seems to us, implies, not a desire for truth, or information. It is more like the spirit of a conundrum-monger who trumps down a puzzler, and "pauses for a reply," with this difference, that he is propounding conundrums which he cannot solve himself, and which indeed he thinks, and it may be, hopes, scientific farmers will not be able to give a very good account of. If the men who call themselves practical farmers do not blend science with their practice and mingle both with brains, they have no more right to be called farmers than the veriest savages that scratch the soil, and raise a precarious crop; they are simply empirics, in the worst and lowest sense of that term. We think we may safely leave Mr. W. B. Smith to be dealt with by his own countrymen, many of whom are something ~~more than~~ *practical* farmers; and in the interval, till he gets a satisfactory reply to his questions, may, we suggest that he should keep his feet warm, his head cool, and subscribe for some good agricultural paper.

If we, says a writer in a German contemporary, reckon that a single grain of wheat produces fifty grains, and the fifty will each produce fifty grains more, and so on, we find—

In the second year	...	2,500 grains.
" third "	...	125,000 "
" sixth "	...	15,625,000,000 "
" twelfth "	...	244,140,625,000,000 "

The third year's crop would give 300 men one meal, leaving enough bran to feed eight pigs for one day. The produce of the single grain in the twelfth year would suffice to supply all the inhabitants of the earth with food during their life time.

COMMUNICATED AND SELECTED.

GAS LIME AS A MANURE.

(To the Editor of the "Ceylon Observer.")

"ON reading your interesting article on 'Gypsum as a Manure,' I was struck with the remarks communicated by a well-informed authority 'who has modestly withheld his name.' I concur with all he says, and, having made the experiments he has recommended, I can vouch for the practical results being in every way satisfactory. You will find the same information given fully in Newbigging's work, pages 84 to 86, and you will also see it quoted (with the authorities given) by Mr. Grinlinton in his letter from the gas works to the *Ceylon Observer* of 10th August 1874, and in his advertisements in the 'Ceylon Directory' of 1874, pages lvi. and lvii. I take a great interest in manures, and have made it a point to cut out all information worth keeping, so that I recognised at once the valuable information in your last night's issue as having appeared before in another form."

We have referred to Mr. Grinlington's letter to the *Observer* in August 1874, and we find he dealt with a point which corrects the rather low estimate of gas lime given in Johnston and Cameron's "Elements of Agricultural Chemistry." There is lime and lime, and we do not suppose there is lime in the world richer in carbonate than that, the result of burnt coral, which is used in purifying the Colombo gas. Its value as a manure is, of course, in proportion. This superiority of the Ceylon coral lime must be borne in mind when our readers look at Dr. Voelcker's analysis quoted by Newbigging, thus :—

GAS LIME:

Its composition, and use in Agriculture.

In a valuable paper on gas lime published in the *Journal of Gas Lighting*, Professor Voelcker states that a copious supply of air is necessary to transform the injurious sulphur compounds contained in the material into fertilizing agents.

When exposed to the air (and the longer it is kept exposed the better), gas lime is in some respects superior to quicklime as a manure.

The oxygen of the atmosphere destroys the offensive smell, and changes the sulphuret of calcium in it—first into sulphite, and finally into sulphate of lime or gypsum, well-known as a valuable fertilizing substance.

In addition to its chemical virtues, gas lime exercises a beneficial *mechanical* effect upon land, by rendering stiff, heavy, clayey land more porous and friable, and by consolidating light sandy soils.

The crops which are particularly benefited by gas lime are—clover, sainfoin, lucerne, peas, beans, vetches, and turnips. It is a useful fertilizer for permanent pasture, destroying the coarser grasses, and favouring the growth of a sweeter and more nutritious herbage.

It kills moss, heath, feather grass, and other plants characteristic of peaty land, its application to which cannot be too strongly recommended.

As a general rule, two tons per acre is the quantity of gas lime which ought to be put on land.

The proper time for its application is in autumn or winter.

During the period of storage, the heap should be turned over once or twice to ensure its complete exposure to the air.

The following is an analysis by Professor Voelcker of a sample of gas lime, *kept long enough to be used with safety as a manure.*

Composition of Gas Lime (dried at 212° Fahr.)

	Per cent.
Water of combination and a little organic matter ...	7·24
Oxides of iron and alumina, with traces of phosphoric acid ...	2·49
Sulphate of lime (gypsum)	4·64
Sulphite of lime	15·19
Carbonate of lime	49·40
Caustic lime	18·23
Magnesia and alkalies	2·58
Insoluble siliceous matter	0·28
	100·00

In fresh gas lime the proportion of water varies usually from 30 to 40 per cent.

The value of the lime used at the gas works here, is, of course, largely increased, in consequence of its use as an ingredient in a valuable manure in which the gas lime and ammoniacal liquor are intimately mixed with blood and other organic matter.

We add here a letter with which Mr. Cochran has favoured us, the object of which perhaps, some reader with a more analytical intellect than we can boast of may guess. What alone is evident to us is that Mr. Cochran, a very competent chemist, evidently belongs to the family of discordant atoms. We have evidently made him unhappy by what he calls "gentle editorial rubs" for his tendency to spoil the effect of useful information by indulging in uncomplimentary remarks on brother chemists. In a recent letter there was an elegance directed against ourselves for being what Mr. Cochran chose to call a "believer in the gospel according to Hughes." We are not aware that we ever said a word against Mr. Cochran, but quite the reverse. But if he thinks it a mortal offence that we should believe Mr. Hughes, Mr. Dixon, and others to be quite Mr. Cochran's equals in science and principle, by all means let him think so. As to the Grinlinton manure we have recently received testimony to its good and lasting properties. Mr. Hughes in his testimony in favour of this manure specially noticed its moderate price.

1st July 1879.

DEAR SIR,—I have been favoured with several of your gentle editorial rubs, for having at one time seen it to be my duty to call in question M. Hughes' prudence, in praising an artificial manure for the large percentage of its cheapest manurial ingredients. Now that Mr. Hughes saw my letters on the subject I have positive proof; but he could hardly have seen my letters without seeing your own editorially-expressed desire for a reply. *Question: why did he not reply? About the fertilising power of* the manure I say nothing. It is well understood that a public analyst of manures must know something of commerce, as well as science, and in making a report upon a manure, must consider the effects of such report on commerce as well as agriculture. With two chemists in the island to contradict me, I have not the slightest hesitation in saying that it would be impossible to produce another instance of an analyst of reputation having praised a manure manufacturer's fertilizer for its large percentage of carbonate of lime. Had the matter been allowed to pass unchallenged, what conclusion was more natural for a planter, unacquainted with chemistry to draw than that he was getting a valuable manure, both commercially and agriculturally, if only it contained plenty of carbonate of lime, and what conclusion was more natural for the merchant to draw than that he could not go wrong in giving the planter plenty of carbonate of lime in his manures, and getting as good a price for it as he could. If such views gained currency, no planter would be safe in ordering more than three tons of manure without an analysis.

Gypsum in superphosphate is another case in point. No analyst of reputation would praise a superphosphate for its large percentage of gypsum. It is well-known that superphosphate cannot be made without the production of gypsum, and that the quantity of gypsum is very variable according to the raw materials used. Thus, if coprolites be the raw material, there is often a considerable amount of carbonate of lime present, which, while it diminishes the value of the mineral and of the resulting superphosphate, increases the percentage of gypsum, as all the carbonate of lime has to be turned into gypsum. It is easy to see, then, since the quantity of gypsum does not bear a fixed proportion to the phosphoric acid present, the former cheap substance may be easily added as an adulterant without detection if kept within certain limits. Hence in England there are unscrupulous manure dealers, who buy a good superphosphate, add a lot of gypsum to it, and sell the mixture at the same, or a higher price than they paid for the superphosphate, to farmers who think they are making money by saving the analyst's fee. M. COCHRAN.

SALT AS A MANURE.

MR. D. MITCHELL, formerly a coffee planter in Rakwana, writes to us (the *Ceylon Observer*) thus from the far south :—

Melbourne, 1st June 1879.

You will see by the slips I enclose that *salt* as a manure is again occupying the attention of agriculturists in this part of the world, and coupled with combined action is likely to lead to beneficial results. You will also observe that the advocates of salt as a manure also characterise it as "the best known *peventive* of rust in wheat." *Top-dressings* we are told "harden the straw," prevent disease from laying hold of the plant, and at the same time increasing the yield. It is to the *preventive* properties in *salt* that I would draw attention in the hope that its use may be found to act beneficially in hardening the *coffee leaf*, against disease. I am told it would most certainly harden the leaves of coffee as it does the straw of wheat. The suggestion is well worthy of a trial. I have now considerable faith in the efficacy of salt. An old friend of mine, proprietor of an estate in the Sabaragamuwa side was in the habit of using it extensively for the destruction of *grub*. No matter what kind of manure it was; all without exception were carefully salted down by him both before and after application on the trees. I have often visited and inspected the coffee under notice, and I must say I was often surprised at the results obtained by my friend's salting process. The soil experimented on was a stubborn one, there was nothing in it to lead to the belief that coffee would grow so luxuriantly or bear so well as it did and is still doing, and its comparative immunity from leaf disease is very remarkable, and speaks volumes in favor of the judicious use of *salt*. The careful investigation of Mr. Morris show clearly enough the progress of leaf disease where once the tree has been attacked, and the suggested sulphur cure may have the *desired effect* in destroying the fungus; still the *origin* or *cause* of the disease remains to be grappled with, and should further investigation solve the problem, planters may indeed rejoice and sound the death knell of the plague spot at once. When in Ceylon, I inclined to the belief that atmospheric influence was the cause. My ideas have, since then, been greatly modified, and the cause is still as great a mystery as ever. I believe, however, that whatever

the cause may turn out to be, that atmospheric influences played a secondary part in the development of the disease in the first instance; contagion, &c. did the rest.

To return to my friend the dry-salter's blind practice in the use of manures, I have often visited and inspected the property in question, and as often have I expressed surprise at the results obtained by steady systematic manipulation of what I considered a stubborn soil. At any rate, there was nothing in it to lead to the belief that coffee would grow so luxuriantly or bear so well as it has done, and is still doing, I believe; and its comparative immunity from leaf disease I now attribute to the judicious use of *salt* to manures of every description. In fact whenever plant life comes to require artificial feeding, salt becomes a necessary adjunct, strengthening as it does the growth of the coffee and increasing the action of the manures applied, and what is better, powerfully assists in warding off diseases of the fungoid type. Mr. Morris' investigations are valuable making it plain how *hemileia* developes and operates on the stem, branches, and leaves of the coffee tree. The suggested *curative* power of sulphur may also be good. Still, something more is needed. We may *cure* the disease, but the origin of the disease remains to be grappled with. How are we to *stamp out* the disease other than by adopting preventive measures? If, as is said, the development of *hemileia* springs from the application of "bulky manures," to stamp out the disease we must abandon manuring and stamp out our crops. That would be a stamping out with a vengeance. Manuring must go on now, or death to the coffee enterprise must ensue. Such being the case, it follows that greater attention must be paid to the mode of manuring, to check a continuance or breaking out anew of the great plague spot, leaf disease. Nature of soil, quality and quantity of manure, mode of application and many other things require careful attention. What is required, in fact, is sanitary reform, clean feeding, and clean surroundings for the coffee plant. Plant food especially must be attended to; it must be well cooked, if I may use the expression, and well *salted* before being brought in contact with the roots of the coffee tree. I am of opinion now that improper plant food applied at random has had a good deal to do with the origin of the disease. It would be idle to point to estates that have suffered severely by the disease that have never had an ounce of manure applied to them, when it is a known fact that the disease is contagious and can be carried about by the wind; the first outbreak of leaf disease on properties with which I was connected was on coffee manured with half-rotted pulp, the spread of the disease over the unmanured portion I can trace clearly to the influence of the wind. One corner of the estate (50 acres) escaped entirely, simply because it was free from wind; what wind it did get, came from S.-W.

(*Enclosures referred to.*)

THE DUTY ON SALT.

(From the *Melbourne Leader*)

A question that will justify the best consideration of the various agricultural societies and farmers' clubs throughout the colony was submitted at the last meeting of the Kyneton Agricultural Society by its president, Mr. Josiah Mitchell, in the shape of the following resolution:—"That inasmuch as salt is essential to the health and well-doing of live stock, and is also the best known preventive of fluke in sheep and rust in wheat, therefore it is desirable in the interests of agriculture, that this society should communicate with all kindred societies throughout the colony, with a view to the presentation of a united petition to the Legislative Assembly for the abolition of the duty on salt." Practical agriculturists and graziers alike, who have used it, have ascertained by experience the benefits of salt as regards its efficiency in promoting the healthy character of both their crops and their stock, while Mr. MacIvor, in his lectures, has almost invariably made a point of dwelling specially upon the agricultural value of salt from a scientific point of view, at the same time suggesting some such unison of action with regard to obtaining the abolition of the duty, as has been put in formal working shape by the president of what is known as one of the most actively useful of our agricultural associations. In his address in support of his resolution, Mr. Mitchell, with the usual ability that distinguishes him in dealing with an agricultural subject, pointed out the claims that salt had to be regarded as one of the most important agricultural commodities, including its use as not only a preventive to, but also a curative of fluke in sheep, while allusion was made to the probable good effects of a top-dressing of salt as a preventive of rust in cereal crops especially in soils deficient of silica.

THE DUTY ON SALT.

SIR,—Permit me to refer briefly to your article under the above heading in last week's *Leader*. Viewed from the standpoint of "party politics" no doubt the allusion made by me to the "bag business" and other duties which farmers have to pay, must, as you pointed out, be deemed "ill-judged"—a mistake. Any one versed in the art of using language to conceal thought would not have made such a blunder. But farmers, as you know, are apt to say just what they think. Yet allow me to assure you, nothing could be further from my intention than the mixing up of "party politics" with the salt question; or to give "the cue" to any one else to do so; and Mr. Wm. Thompson, in the course of his remarks, wisely counselled avoiding politics. The free use of salt for agricultural and pastoral purposes, to enable farmers and stockowners to obtain the greatest amount of grain, wool and flesh from the land whereby increasing the wealth of the community—is such an absolute necessity, that the question of removing the duty from that article may be safely allowed to rest on its own intrinsic merits. It is now about ten years since I brought the great importance of salt as a cure and preventive of rust in wheat, under the notice of the members of the Ballarat Agricultural and Pastoral Society, and denounced the policy of putting a duty of 20s. a ton on an article so essential to successful farming. And I remember Mr. G. G. Morton—now president of that influential society—relating how he had saved his crops from rust by the use of salt, at the same time regretting that in consequence of the duty salt had become so dear it would not pay to use it. Mr. Gilchrist also spoke in favor of salt for cereals.

Regarding now as I did then, a flaggy over-luxuriant growth, and consequent soft straw, as the pre-disposing cause of rust in wheat, and knowing science and practical experience to have demonstrated the fact that a top-dressing of salt checks over-luxuriance, hardens the straw and prevents rust, I should deeply regret if any expression of mine had the effect of deterring farmers of all shades of politics from uniting as one man to make "a strong pull, and a pull altogether" to remove the duty from this—as you fitly term it—"important agricultural commodity." Forecasting the future by the past, the chances are we may have another season of rust to contend with. Should this unfortunately happen, salt ought to be available; therefore, as you have remarked, the question "submitted by the Kyneton Society "will justify the best consideration of the various agricultural societies, and farmers' clubs through the colony"—apart altogether from party politics.—Yours, &c.,

JOSIAH MITCHELL.

Skelsmergh Hall, Kyneton, 17th May.

It will be observed that it is not as a "topical" application that Mr. Mitchell advises the use of salt for coffee, but as a condiment mixed with its root food. There is no substance (perhaps) on the manurial value of which there has been so much diversity of opinion as chloride of sodium. Mr. Josiah Mitchell has mentioned its least controverted quality when he states that common salt checks over-luxuriance of straw and leaf. This is when moderately applied, for in large quantities it annihilates vegetation.

As salt is subject to a heavier impost here than is the case in Australia, we submit that the best possible form to obtain it is as it exists in the German mineral kainit. From Wrightson's handbook we quoted so favourable an account of this mineral that we wonder no import has taken place. Has any planter tried it? If not, why not?

The more impure salt is, the better fitted we imagine it is for use as a manure; and although the Ceylon Government cannot afford to give up the revenue derived from the salt monopoly, yet we suspect there are large deposits on our coasts of *salt mud*, from which salt never has been and never can be crystalized. Could not this substance, containing other salts in addition to chloride of sodium, be rendered available as manure?

MANURE ANALYSES AND THEIR INTERPRETATION.

THE following instructions for selecting manure samples for analysis, and also for the interpretation of analyses, have been prepared by Dr. Aitken, chemist to the Highland and Agricultural Society, and were distributed at the half-yearly general meeting of the society last week. These directions are likely to be of great service to farmers and others interested in the analysis of manures:—

THE SELECTION OF SAMPLES FOR ANALYSIS.

Manures.—About half-a-dozen bags should be chosen for sampling. Each bag should be emptied out separately on a clean floor, worked through with a spade, and one spadeful taken out. The five or six spadefuls thus selected should be mixed together until a unifrom mixture is obtained. Of this mixture one spadeful should be taken, spread on paper, and still more thoroughly mixed; any lumps which it may contain being broken down with the hand. About half a pound of this mixture should be sent for analysis in an air-tight box to prevent its gaining or losing moisture. Should there be large hard lumps or stones present, five or six pounds are required for analysis. (A half pound sample is sent by post for 4d.)

N.B.—This should be done in the presence of a reliable witness. Two samples should be taken and sealed, the one sent on and the other retained for reference in case of dispute.

Feeding mixtures.—These should be sampled in a similar manner,

Feeding cakes.—A cake should be broken across the middle, and, from the break, a piece should be taken across the entire breadth of the cake, and sent for analysis. The rest of the cake should be kept for reference.

Soils.—Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench a perpendicular section of the soil down to the top of the subsoil, and about four inches wide. Extract it carefully, and do not allow the subsoil to mix with it. A similar section of subsoil immediately below this sample should be taken and preserved separately. Five or six similarly drawn samples should be taken from different parts of the field, and kept separate while being sent to the chemist, that he may examine them individually before mixing in the laboratory.

Waters.—The bottles or jars in which samples of water are sent should be thoroughly cleaned. This is done by first rinsing them with water, then with a little oil of vitriol. After pouring this out the bottle should be rinsed six times with water, filled, corked with a new washed cork, sealed, and sent *without delay*. (Chemically clean bottles may be had at the laboratory.)

Well water may be collected at any time, but it should be allowed to run for some time before the sample is taken.

Spring or steam water should be collected when the weather is dry.

In the analysis of a mineral water it may sometimes be desirable to determine the amount of gases held in solution, in which case certain precautions must be observed which require the presence of the chemist at the spring.

SCALE OF FEES.

Manures	£1	0	0
Feeding stuffs	1	0	0
Water, sanitary analysis	1	0	0
Water, full analysis	5	0	0
Soil, analytical examination and recommendation of manures	1	10	0
Soil, full analysis	5	0	0
Partial analysis, each constituent	0	10	0
Testing for gross adulteration	0	5	0
Advice	0	5	0

INTERPRETATION OF ANALYSES.

The following notes will be found useful in enabling those unacquainted with chemistry to interpret analytical reports :—

1. MANURES.—The three items of greatest importance in manures are phosphoric acid, nitrogen, and potash. (1) *Phosphoric acid* is present in manures as such, and also as phosphates of lime, magnesia, iron, and alumina. Phosphate of lime is most important, and exists in two states, insoluble and soluble. INSOLUBLE.—Insoluble and soluble phosphate of lime, called also tricalcic phosphate, and tribasic phosphate of lime, contain about 46 per cent. phosphoric acid. SOLUBLE.—Soluble phosphate of lime, called also acid phosphate of lime, contains about 61 per cent. phosphoric acid. Some analysts prefer to state the soluble phosphate as—biphosphate of lime, called also monocalcic phosphate, contains about 72 per cent. phosphoric acid. The soluble phosphates are usually stated as equivalent to so much tricalcic phosphate. Soluble phosphate, multiplied by 1½ biphosphate, multiplied by 1½, gives the equivalent of tricalcic phosphate nearly. Phosphate of magnesia occurs in small quantity in bones, &c., and is usually reckoned as tricalcic phosphate. Phosphates of iron and alumina when occurring in small quantity are usually reckoned as tricalcic phosphate. *N.B.*—Phosphates of iron and alumina may occur in such a form as to be worthless as a manure. It would save ambiguity if all phosphates were described as containing so much anhydrous phosphoric acid (P_2O_5) in a soluble or in an insoluble. This amount, multiplied by 2·18, would then give the equivalent of tricalcic phosphate. (2) *Nitrogen* occurs in manures mostly in three forms. Ammonia salts, nitrates, and albumenoid matter. Ammonia sulphate (pure), contains 25¾ per cent. ammonia; ammonia chloride (pure), contains 31¾ per cent. ammonia. Nitrate of soda (pure), contains 16·47 per cent. nitrogen, equal to 20 per cent. ammonia. Albuminoid matter contains about 16 per cent. nitrogen, equal to about 19 per cent. ammonia, which sooner or later becomes available as plant food. (3) *Potash* is found in small amount in most manures, and should be reckoned as anhydrous potash (K_2O). Sulphate of potash contains potassium=59 per cent. anhydrous potash. Muriate of potash contains potassium=fully 63 per cent. anhydrous potash.

2. FEEDING STUFFS.—These are chiefly concentrated forms of food whose value depends on the amounts they contain of albumenoids, oil, and carbohydrates. *Albumenoids* are compounds containing nitrogen, and more or less resemble dry flesh in their composition. They are sometimes called *flesh-formers*. They are the most valuable constituents of feeding stuffs. The percentage of nitrogen contained in a cake multiplied by 6¼ gives the percentage of albumenoids. Good linseed, cotton, and rape-cakes should contain from 4 per cent. to 5 per cent. nitrogen about 10 per cent. oil and about 6 per cent. ash. Carbohydrates are compounds such as sugar, starch, gum, and woody fibre. (The *digestibility* of woody fibre varies very much, but chemical analysis cannot determine this with any certainty.)—*North British Agriculturist.*

WELL CULTIVATION.

WE are not aware if the system of well cultivation, so common in the Jaffna peninsula, is practised to any extent in India, though it would seem more than probable that it was originally introduced from the South of India by the early Malabar invaders of the island. The system is at any rate spoken of in the *Calcutta Review* as a novelty, possibly in regard only to the locality where it was introduced : but the *Pioneer* in noticing the article in question, is equally warm in its praises as a system likely to benefit native cultivators and therefore deserving of every encouragement.

In noticing the article in the *Review*, our Allahabad contemporary mentions this system of well cultivation as having been quietly worked out in the district of Sarun in Lower Bengal. The author of the scheme is neither an engineer nor a civilian, but a sub-Deputy Opium Agent, who, taking advantage of certain rules of his department, has during the past five years constructed 2,500 new masonry wells and repaired 300 old ones, at an average cost to the State of between Rs. 3 and 4 a well. The actual expenditure was Rs 77,000, but the whole of this amount has been recovered. It was advanced in sums of about Rs. 50 for each well, and the loss to Government is the interest, which the *Reviewer* calculates at 4½ per cent., to amount during the two years and a quarter in which it is being recovered, to Rs. 8¼. Further on we learn that during the present year 420 new wells are being made and 45 old ones repaired. The wells are constructed of dry masonry, cost seemingly from Rs. 80 to 121 each, and are expected to last a hundred years. Mr. Tytler states that he is usually able to induce the zemindar to supply the wood for brick burning, whilst the ryot gives Rs. 15 or Rs. 20 besides his labour. Indeed the most notable circumstance of the system is that it works through this combined self-interest and independent action of the landholder and tenant, the tie uniting these two ordinarily opposing forces being the personal influence of Mr. Tytler. The effect of these wells on general cultivation when poppy is not on the ground is said to be very great. The *Reviewer* seems to seek specially to draw attention to what he regards as the successful result of honest unpretending hardwork. His claim to notice is not unjustified by the facts.

Unfortunately the summary of the *Calcutta Review* article supplies no particulars as to the nature of the soil or the depth to which the wells were sunk. In the Jaffna peninsula, where we know that the system of well cultivation is extensively and successively carried on, the soil is light and easily worked, and we believe the late Mr. Russell, when Government Agent of the Northern Province, applied to the Government for a vote of money for this purpose at the rate of five pounds a well, so convinced was he of the utility and economy of this means of irrigation that when the money was refused by Government, he commenced expenditure out of his own private means, but unfortunately for the district he was promoted to the Central Province, before he could carry out much of his plan.

One great advantage which well irrigation offers is, that it furnishes a supply of water throughout the year ; but very rarely indeed if the wells be sunk to a proper depth, will the water supply fail altogether. Now we have seen in certain districts of this Island, how expenditure on village tanks has proved of no avail during seasons of extreme dryness; and engineering ingenuity has been taxed, and extensive and costly schemes have been devised, for bringing a supply of water to them from considerable distances, in order to obviate the effects of the absence of rainfall during the most critical times of the year. We have an instance of this in the project of the Yodo Ella irrigation works in the North Central Province, estimated to cost £40,000, but the expenditure is so large that Government hesitates to sanction a vote for this purpose, knowing well that once begun, the work must be continued to the end, and that it is possible this amount may be considerably increased even after the most careful estimates. The question naturally arises in this case, whether instead of entering upon a large outlay, an attempt might not be made, by the construction of wells and lifting apparatus, to obtain a sufficient supply of water to meet the occurrence of dry seasons.

The same remarks will apply to certain districts of the North-Western Province, where the cost of constructing works for irrigation purposes on the ordinary system, is often found to be in excess of any probable returns. The cost of sinking a well will of course depend on the nature of the ground and the depth to which it would have to be sunk, and it would of course happen that in some localities, where large masses of rock was found that the sinking of wells would be impracticable, but careful borings would settle all these questions, and we have brought the subject forward, in the hope that the success which has attended irrigation by means of wells in Bengal, equally with the system in the Northern Peninsula, may be the means of inducing the authorities to turn their attention to the subject, before any further large expenditure be incurred in the construction of irrigation works upon the old system.—*Ceylon Times.*

IRRIGATION IN THE NORTH-WEST.

THE report on the *khurreef* irrigation operations in the North-Western Provinces for 1878 contains some valuable figures. The area irrigated was only 660,026 acres against 731,583 acres in 1877, a falling off of 71,557 acres. The revenue, however, only showed a decrease of Rs. 16,597, being given at Rs. 18,56,440 against Rs. 18,73,037 in 1877. But this marks a vast increase in the returns, as the figures given will show. Income in 1869, Rs. 12,24,232 ; 1876, Rs. 13,56,576 ; 1877, Rs. 18,73,037 ; 1878, Rs. 18,56,440. That the revenue has not fallen off is due to larger breadths of lands having been devoted to the more valuable crops. The coarser food-grains and cotton show a falling off, but rice has increased by 12,573 acres, sugar by 8,656 acres, and indigo by 13,998 acres. The total area under indigo in the three years prior to 1877 averaged 157,000 acres ; in 1878 it had risen to 227,220 acres. Sugar has risen from 129,607 acres in 1876 to 147,661 in 1878 ; but rice has not yet recovered the area it occupied in 1876. The land under this crop was in that year 84,744 acres, whilst last year it was 79,257 acres ; but then against this must be set off the extraordinary increase in maize, which has risen from 27,424 acres in 1876 to 65,818 acres in 1878. Other food-grains, too, show a similar expansion, having increased from only 2,533 acres in 1876 to 19,926 acres in 1878. It is a pity more attention is not given to the cultivation of maize in the Bengal Provinces.—*Indian Daily News.*

MADRAS SCHOOL OF AGRICULTURE.

(To the Editor of the Madras Athenæum.)

SIR,—I am glad to see that the Madras School of Agriculture is progressing favorably under the able management of Messrs. Robertson and Benson. Although the former gentleman is enjoying his *otium cum dig*, I am glad to observe that the institution under the charge of Mr. Benson is being worked in a most satisfactory manner. As I am much interested in agricultural pursuits, I don't think it would be out of place to ask you to give insertion to the following particulars in your widely circulated journal. The institution as you are aware is, designed to afford instruction in the science of agriculture, and in the practical application of sound principle in conducting the ordinary agriculture of this country.

The farm is conducted as an experimental farm; its area is about 280 acres, and it is well provided with suitable buildings.

In the farm workshops all kinds of agricultural implements and tools suited for use in India are manufactured and repaired.

The educational buildings needed will be erected on the farm; of these, a chemical laboratory has already been built on an adjacent site.

In the neighbouring village of Saidapet students can readily obtain board and lodging during their course of teaching; and a limited number of quarters have been provided on the farm for such students as are willing to rent them.

An agricultural library and a museum are in course of formation, and a reading room for the use of students has been provided.

A veterinary hospital will also be established when funds are forthcoming.

The institution is attached to the Educational Department under the general control of the Director of Public Instruction, acting in communication with the Board of Revenue. The direct management of the institution is entrusted to the Superintendent of Government Farms, who conducts all correspondence regarding the institution; issues all notices, orders, &c., regarding the delivery of lectures and other matters connected with the routine of the institution; and maintains discipline amongst the students, who are in all things subject to the orders he issues.

The course of instruction extends over three years; there are two sessions in each year, a summer session and a winter session; the summer session begins each year on the 1st of April and ends on the 30th of June; the winter session begins on the 1st of October and ends on the 31st of March. Though, in the winter session, class-room and lecture-room instruction does not begin until the 1st of October, students are nevertheless expected to attend at Saidapet on the 1st of September, in order that they may witness and take part in the important field operations conducted at that season in connexion with the sowing of the cold weather crops.

The instruction given in the institution embraces a thorough study of Agriculture and of such portions of Chemistry, Geology, Zoology, Botany, and the Veterinary art as bear on the theory and practice of agriculture. In addition to these special subjects, the following also receive attention:—Farm book-keeping, land-surveying, mensuration, and drawing. The instruction is given by means of lectures, class-room discussions, and field classes.

During the portion of the day set apart for practical instruction in farming out of doors, every student is expected to take part in whatever work may be going forward on the farm; compliance with this regulation will be enforced. Each student is expected to make himself strictly acquainted with all the operations daily performed on the farm, and is required to keep a journal or diary of the same.

Instruction is conveyed in the English language, but the masters will afford as much assistance as possible in explaining the lectures and instruction generally to students whose limited acquaintance with English may make it difficult for them to follow such instruction without explantion.

Europeans, Eurasians, and Natives of all classes and from any part of the country are eligible for admission into the institution when vacancies exist, on complying with the following conditions:—

Candidates who desire to avail themselves of stipendiary studentships or scholarships must be between sixteen and twenty-four years of age, and must produce with their application for admission the following certificates:—

(*a.*) Certificate of age.
(*b.*) Do. of character.
(*c.*) Do. of physical fitness.

For the present no fee will be charged, except in the case of students who enter only for instruction in special subjects; strict conformity with all the rules of the institution will be enforced.

Students must provide themselves with all necessary text-books, stationery, &c.

Students who have passed the Matriculation or General Test Examinations will be eligible for admission without undergoing any further examination, provided they produce the certificates needed, and comply with the other conditions laid down. When there is a greater number of these candidates than there are vacancies to fill, a selection will be made of the most promising at the discretion of the superintendent.

Of the students who have at the close of the first session been most successful, five will be selected to fill stipendiary studentships established by Government, to which will be attached a monthly salary of Rs. 10 in the latter half of the first year, Rs. 12½ per mensem in the second year, and Rs. 15 per mensem for 9 months in the third year, under the following condition:—

No stipend will be increased unless the holder obtains half of the total marks given, and one-third of the marks allotted to each subject in each session. The stipend will be liable to be forfeited in part or in whole for continued disobedience to orders or neglect of duty, and no person who holds a stipendiary studentship will continue to hold it if found to be unfit to undergo further training from incapacity or want of interest. Stipends cannot be held for more than two and a half years, and cannot be retained unless the recipient pass for the higher grade within twelve months.

One scholarship, of the value of Rs. 10 per mensem, and tenable for two years, will be given to the student who, at the end of the first year of training, secures the largest number of marks, and who, in other respects, has given satisfaction. This scholarship is to be held under the same general conditions as applicable to stipendiary studentships.

At the conclusion of training, students who are found to possess the necessary knowledge, and whose conduct has been satisfactory, will be entitled to certificates certifying to their qualifications as agriculturists under the following rules:—

First-class Certificate.—To qualify for this certificate the student must throughout the whole course of training have obtained 33 per cent. of the total marks for each subject of instruction, and 60 per cent. of the sum total of such marks in each session.

Second-class Certificate.—To qualify for this certificate the student must throughout the whole course of training have obtained 25 per cent. of the total marks for each subject of instruction, and 40 per cent. of the sum total of such marks, in each session.

A student who fails to obtain 33 per cent. of the total marks allotted for a subject in a session and yet obtains 60 per cent. of the sum total of the marks in the session, will be allowed in the following session a special examination in the subject in which he has failed, and if he passes satisfactorily, he will be deemed to have passed the first standard in that session; and in the same way a student who may have obtained 40 per cent. of the sum total of the marks in the session and yet has failed in getting 25 per cent. of total for each subject, will also be entitled in the ensuing session to a special examination in the subject in which he has failed, on passing which successfully he will be considered as having passed the second standard of that session.

Arrangements will be made under which young men who are studying in Madras to qualify themselves as school-teachers will be permitted to attend one or more courses of lectures and to undergo a partial training in practical agriculture at the institution, with a view to teaching this subject in middle class and elementary schools under their charge.

Land-owners and others may enter students at the institution under the same rules and regulations as Government stipendiary students, provided the stipends are paid regularly one month in advance to the Superintendent, Government Farms, by whom these stipends will be disbursed under the rules prescribed.

Persons of any age above sixteen who possess a fair knowledge of English may enter the institution, to study any special subject or subjects taught therein. They will be required to pay a fee of Rs. 2 per mensem during the time their names are entered in the register of the institution.

A. C.

THE MADRAS SCHOOL OF AGRICULTURE.

WE are glad to learn that, after undergoing their three years course of training in the above named institution, the following students, who entered it in 1876, when it was first opened by Government, have qualified for a first class certificate:—

N. H. Patuck	E. B. Krishna Row
G. Krishna Prabhu	C. Annamalay Moodelly
C. K. Soobba Row	K. M. Nagojee Row
M. Narayana Row	F. N. Kambatta
R. D. Tata	J. M. Chichgar
N. M. Rego	B. Ramiah Reddy
V. S. Gurunatha Pillay	B. H. Ratwal
P. D. Moody	V. Streenivasa Iyer
A. D. Colah	

Besides the above named, the following have obtained second class certificates:—

T. Varathiah	B. M. Dadiana
R. Damodara Naidu	T. Balasundrachary
M. Damodara Moodelly	

The searching nature of the tests which these students have undergone is testified to by the fact that they have had to pass upwards of 100 examinations, held weekly during their course of instruction. This plan we commend to our educationlists, as being one that, in as great a measure as possible, prevents the ill effects of cram, as it obliges students to maintain continuous study, instead of allowing them to work by fits and starts at long intervals. It is very satisfactory to note that of the students who went through the whole course with this class, 63 per cent. have obtained a 1st class certificate, and 19 per cent. a 2nd-class certificate; of the former, six have been engaged by the Government of Bombay as agricultural instructors in the High Schools of that Presidency, under Sir Richard Temple's scheme; one has obtained similar employment under the Jaghiredar of Arnee on his estates; and another is a student who was maintained by the Indore State. Several of the remainder are, we believe, going to engage in farming on their own account in various parts of India; but we trust that the Madras Government will not lose the advantage of making use of the services of these men, whom they have trained, in a manner similar to the Bombay Government, which has obtained instructors educated at no expense to themselves. These certificate-holders ought to be immediately employed in the various branches of the Revenue Department connected with the administration of the land. —*Madras Mail.*

Our readers will remember that Mr. F. E. Harman, the Superintendent of the late Experimental Farm at Bangalore, was engaged some two years ago, by the Mysore Government, to write an Elementary Manual of Agriculture, for use in schools in the province. Our local contemporary states that the Government have awarded him one hundred rupees as an honorarium for the job, but, strange to say, a copy of the Manual has not been sent to the press as yet for review. We need hardly point out that improved agriculture is a matter which deeply affects this province. While on this subject may we ask what has become of Mr. Harman's report on the agricultural tour he made through the province, as well as his opinion on the coffee leaf disease question?—*Examiner.*

TEOSINTE.—This new fodder-grass has attracted considerable attention in France and her colonies, during the last few years on account of its excellent qualities and enormous yield of foliage. It is a native of Guatemala, and was first introduced to the notice of the Acclimatisation Society of France in 1872, by Monsieur Durieu de Maisonneuve, and was tried in various parts of the south of France with considerable success, the plants growing to a height of 10 feet, and each plant throwing up about 100 stems. The *Teosinte* is a remarkably handsome plant, having leaves three to four feet long and two or three inches wide, and having an appearance resembling maize, but on a much larger scale; the cob, as in that plant, is contained in a leafy sheath, from which the stigmas protrude in a tassel-like manner. At Kew, where it flowered in December, in the water-lily houses, it attained a height of 15 feet. Schweinfurth, who has seen it growing and producing seed at Cairo, confirms its valuable qualities. Seeds have already been distributed to Cyprus, the East and West Indies, Australia, and tropical Africa.

PITHECOLOBIUM (INGA) SAMAN, AND P. (INGA) DULCE.

(Contributed).

IN reference to a letter in our columns on the former, we think it well to afford the following information respecting those two South American trees, now very common in Ceylon.

These and other trees now placed in the genus *Pithecolobium*, have at different times been described as *Mimosas* or *Ingas*. The *Pithecolobium saman* was introduced to Ceylon about fifteen years ago by Dr. Thwaites, and its pods, which contain a sugar-like pulp round the seeds, a good deal like those of the carob, and the young leaves and twigs were supposed to be good fodder for cattle, but on this subject we have not heard if they have been so used in Ceylon. The tree is one of the fastest growing ones introduced, forming a very large spreading tree in about nine or ten years, with an umbrella-shaped top. It flowers freely in Colombo, but bears fruit better at higher elevations.

It is now in great demand in Southern India as a shade tree, but we question if it is not too dense for this purpose.

We are not aware that those planted in Colombo have been particularly neglected. The flowers when looked at singly are rather pretty, but for these the tree is not conspicuous, as they are generally high up on the top of the tree, and so concealed by the leaves that they are scarcely seen unless purposely looked for. It is well-known to botanists that all plants of this order, *Leguminosæ*, sleep at night, that is, their leaves close up and hang down or droop, and some, like the present one, are affected by sudden changes in the weather. The leaves of this tree, and their pinnæ, or larger divisions, have peculiar swollen stalks of a soft flexible nature at their bases, and droop down quite suddenly when evening comes on, and even when the sun is suddenly obscured, and some people in Colombo call it "*the sleeping tree*" in consequence of this extreme sensitiveness. We are not sure as to the quality of its timber, but as a fast growing tree producing large quantities of firewood, strongly recommend it.

Pithecolobium (*Inga*) *dulce* is now a well-known tree in Colombo, and the avenue forming a perfect arch overhead growing along the sides of Skinner's-roads north and south from the Maradana-road to Korteboom-street, planted about eleven years ago, is very much admired, and strangers visiting Colombo are very much struck with it. Dr. Bennett, the Australian naturalist, when lately in Colombo, said it was one of the most pleasant sights he had seen about our town.

This plant flowers and fruits very freely in Colombo, and the young plants from the dispersed seeds come up in thousands under the parent trees. The pulp surrounding the seeds is so sweet that crows and various other birds are seen constantly feeding on them, and even our Colombo children have discovered that the specific name of this tree, "*dulce*," is not meaningless. In Colombo this tree is called "the Madras fence plant," "Madras thorn," and in Madras, the natives call it *korkapully*. When on a visit to Madras in 1849, the writer of this was so struck with the beautiful hawthorn-like fences formed of it that he introduced seeds of it, and of the famous *flamboyant*, both of which he had several large plants growing at his residence at Muttawal under the impression then, that the Madras fence plant was new to the island, but we believe that Mr. Shand had introduced them and formed those beautiful fences of them close to *Wavertree House* in Vauxhall-street. It was subsequently discovered that an old tree of this plant was still growing at Kew Point in Colombo, and most likely introduced from some part of India by Mr. Moon, or General Hay MacDowall, about sixty years ago, so that not only Colombo but all Ceylon could have been long before 1849 supplied with seeds or cuttings from the old solitary tree at Kew Point. This also is one of the fastest growing trees introduced into Ceylon, and when properly cared for and trimmed, it makes the most effective and handsome fences in the island. Some large fine trees grow in the Racket Court and close to the Colombo *cutcheri*, but the tree is now so common and so useful that we quote the following notice of it and some other species, from Maunder's "Treasury of Botany":—

P. dulce, a large tree, native of the hot regions of Mexico, produces cylindrical irregularly swollen pods curled at the top, containing a sweet edible pulp, which the Mexicans, who call the tree Guamuchil, boil and eat. The Spaniards introduced it into the Phillippine Islands, from whence it has been carried to India; and it is now planted along the lines of railway in the Madras Presidency, where the fruit is known as Manilla Tamarinds. Other species, such as *P. saman* in Brazil and Venezuela, also yield eatable pods, which are given to cattle like the carob pods of Europe. Those of *P. cyclocarpum* possess saponaceous properties and are used as soap in Caraccas, as also is the bark of *P. bigeminum*, or an allied species, in Cochin-China; while the bark of *P. unguis-cati* is astringent.

The *P. bigeminum* referred to above was collected in Ceylon by Paul Hermann in 1660-67, and described in the Flora Zeylanica of Linneus, No. 218, p. 97,) as a Mimosa. Besides this one, which is common enough near Colombo, the "Enumeratio Plant, Zeyl." contains *P. geminatum*, *P. umbellatum*, and *P. subcoriaceum*, the last being a new species described by Dr. Thwaites.

Referring to the gardens at Kew Point, we quote the following from Colonel Campbell's "Excursions, &c.," in Ceylon, written, we believe, in August 1819, a short time after the Colonel's arrival in Colombo:—

If we take a morning's walk, which is seldom, it is usually in the botanical gardens, which have been lately much improved by Mr. Moon, the superintendent, under the auspices of Lady Brownrigg, and now contain many rare and beautiful trees, shrubs, and flowers, collected throughout the interior, where several new and splendid specimens have been found. The different walks being also tastefully laid out and neatly kept, these gardens did fair to surpass those at the Cape of Good Hope; and their situation, being all but an island in the lake, renders them in this respect very superior.—*Ceylon Observer.*

CATTLE FOODS.

WE take the following table from the *Country Gentleman's Magazine.* It will be of value to the observant cattle-breeder. The table is compiled by Professor J. P. Sheldon.

Constituents of cattle-foods.

1878.	Albuminoids.	Starch, sugar, gum, &c.	Fat.	Manurial value per ton in shillings.
Linseed cake ...	28·3	41·3	10·0	70
Decorticated cotton cake ...	41·0	57.0	—	105
Undecorticated " " ...	24·0	46 9	—	58
Bean meal ...	25·5	45·5	2 0	62
Pea " ...	22·4	52·3	2·5	62
Rye " ...	11·0	69·2	2·0	30
Rice " ...	6·9	77·0	—	25
Palm nut meal ...	14·0	76·0	—	28
Wheat bran ...	14·0	50·0	3 8	55
Oats ...	12·0	60·9	6·0	28
Barley ...	9·5	66·6	2 5	25
Malt ...	9·0	76·0	—	26
Malt coombs ...	26·0	60·0	4·0	71
Alsike clover in blossoms ...	15·3	29·3	3·3	2
White " " ...	14·9	34·3	3·5	2
Red " " ...	13.4	29·9	3·2	2
Lucerne ...	14 4	22·3	2·5	2
Common Meadow Hay ...	8 2	41·3	2·0	15
Pea straw ...	6 5	35·2	2·0	8
Oat " ...	2·5	38·8	2·0	8
Barley " ...	3·0	32·7	1·4	8
Wheat " ...	2·0	30·2	1·5	8
Potatoes ...	2·0	21·0	0·8	7
Carrots ...	1.5	7·0	0·2	4
Turnips ...	1·1	5·1	0·1	4
Mangels ...	2·0	8·0	—	5

Too little attention is paid to this subject, and while we feed our cattle usually on gram or dhall, there are many articles cheaper and much better, we have found a horse thrive wonderfully on one seer of cotton seed cake being substituted for one-and-a-half seers of gram.

A NEW FODDER-YIELDING TREE FOR INDIA.

AT page 72 of the *Journal of the Society of Arts* for December 20th, 1878, in the notice of the report of the Calcutta Botanic Garden, a reference is made to the introduction into the garden of a South American tree, known as *Calicandra saman*. Besides its introduction into the Calcutta Garden, the prospect of its general cultivation in India as a fodder-yielding tree has been brought before the Agricultural and Horticultural Society of India, and seeds obtained, some of which have been transferred to the Society's garden, and the remainder distributed among the members. A report on the tree has also been obtained from the

superintendent of the Botanic Gardens, Jamaica, from which the following particulars are gathered:—The tree, seems to be popularly known in Jamaica as the "guango," and is one of the most magnificent features in the existing Jamaica Flora. It is supposed to have been originally brought from the American mainland as seed by Spanish cattle, and has now become thoroughly naturalised in all the dry regions. It is described as a lofty tree, in general habit much resembling the English oak. The trunk is thick, generally short and branched a few feet from the ground. The primary branch divisions are often tree-like in size, measuring nine to twelve feet in circumference at the base. The lower branches spread horizontally, and the upper are erect, spreading, giving the tree a flattish dome-shaped appearance. Trees are not unfrequently seventy feet high, the diameter of whose branch expansion horizontally is over 30 feet.

The shade which this tree affords, is of a light lifesome character, with gleams of sunlight stealing through and flitting about as the branches wave with the breeze. This characteristic, coupled with the fact, which is of equal importance to healthy vegetation, that the leaves and leaflets rigidly close together at night, thus admitting the free descent of the dew to the ground, together with its squat-like brooding habit, form its first great value as a pasture tree. It is without doubt the finest pasture tree on the island. Grass grows freely within the overshadowing of its ample arms, close up to its trunk. On this account alone it should be planted in pastures wherever it will thrive as a grateful shade for cattle. Beyond this is the important consideration of its being a fodder-yielding plant itself, and this in an important degree, both for quantity and quality of the yield. The fruit, when ripe, is a bright dark brown pod, six to ten inches long, barely an inch wide, and a quarter of an inch thick, the substance of the pod consisting of a sugary amber-coloured pulp. These pods are borne in great profusion, and hang, before arriving at maturity, dangling in clusters from every branchlet. As they ripen, they drop to the ground, and are picked up and eaten with much relish by all stock, even sheep and goats. Cattle may be seen lingering about the trees, waiting for the passing breeze to shake the fruit down. Its excellent quality as a fodder is evident by its fattening effect. Stock having access to it improve markedly during the time it is in season. From the sugary nature of the pod, it will keep good a long time, packed after maturity. It is therefore often gathered, packed in barrels, and kept for use till the dry early spring season has parched up the grass, and made herbage scarce. The tree thrives best in dry, hot plains, having a small or moderate annual rainfall. It is true very large trees are occasionally found in wet districts, but they lack the conspicuously healthful and luxuriant branch development of trees on the plain. They are also much less fruitful, and the fruit is less plump and mucilaginous in substance. Hot plains, having an annual rainfall of from 30 to 60 inches, appear best adapted for its successful growth. Like many other plants, too, there is no doubt that a maritime influence is particularly favourable to its development.

The tree is a very rapid grower, and, if it were extensively cultivated, the pods would, no doubt, become largely used for feeding cattle. As a shade tree, along roadsides or open places of resort, it has special recommendations, and no doubt will be largely planted as it becomes more known.—*Society of Arts Journal.*

LIBERIAN COFFEE AND FODDER FOR CATTLE.

(*To the Editor "Madras Standard."*)

MERCARA, 4th July.

As much as the cinchona is proving to be an undoubted success in Coorg, so is the Liberian coffee as complete a failure.

It has been experimented on in many ways at elevations from 3,500 down to 2,200 feet from imported seedlings brought from other parts of India, and also direct from England *viâ* Mangalore; it has been tried to rear the plants themselves from berry and parchment seeds brought direct from Africa, *viâ* London, and by parcel post to India. Two specimen plants growing in rich loamy soil, well protected from wind and rain, are only 18 inches high, with two sets of primaries; whereas the common or original coffee, with similar advantages, would now be standing over [illegible] feet in height, ready for topping and with a sprinkling of blossom or berries on them.

From out of a quantity of Liberian coffee seed that I planted in July 1877, only one seedling appeared which died during the last year's monsoon.

Again in July 1878, I planted out the Liberian coffee seed in berry, *i.e.*, with the outer husk on, when only 5 per cent. came above ground. They have now got two pairs of leaves, and are more or less five inches high. As seedling orange trees will never bear fruit in England, having first to be grafted to make them bear of some scions from a fruitful tree; it seems possible that the Liberian coffee seedling are in a degree similar in Coorg and will not repay cultivation.

Some roots of the Prickly Comfrey (brought from England) were planted out in Mercara in the beginning of 1878. They grew well and quickly on very poor soil (an old rice field) but strange to say, neither horses nor cattle could be made to eat it, when brought [illegible] and placed in their stalls. Even hungry, lean cattle, grazing on the exhausted grass round where it is planted, shunned it, although lying directly in their path. Two different grasses grow here uncommonly well, the Mauritius grass and the Guinea grass: of the former some swampy ground had a few roots thrust carelessly in eight years ago; it spread so quickly that in two years some three acres of ground were covered with it, and standing three to four feet high; the whole year round I get my supply of fodder for stall-fed cattle from that place and they prefer it to the local rice-straw (as straw is selling at Rs. 20 per 1,000 small bundles it is a great saving). There is one very great drawback to its spreading, for the women told off daily to bring in this grass, had to pass through the coffee trees, or surreptitiously did it, in making short cuts, to finish their contracts early, and from accident small pieces or joints fallen on the ground have taken root, and now yearly there must be gangs of coolies employed in March, digging it out of the ground, to be brought up in armful on to the roads where heaps are made and then burnt. Cattle are fond of this grass, and stray cattle belonging to the Coorgs have frequently to be pounded or driven away, as they are attracted to it greatly either by smell or sight. I have repeatedly asked some of these men to take an armful away, and plant it in some of their many ravines or swamps, but their old conservatism is still very strong; they say—"During the rains there is plenty of grass everywhere, and in the dry season we have our straw." Hares are particularly fond of Mauritius grass, and I think one cause of its spreading where no traffic is, is owing to these little animals nibbling at the roots of it, so that the stalks will fall, that they may get at the succulent tops, and then dragging the stems little by little further and further away, where it again takes root. Wild animals, sambur and jungle sheep, also come into the estates occasionally to feed on it.

Guinea grass on the other hand thrives well on ridges and other barren parts, and it grows in bunches or clusters. These can be subdivided like rice seedlings, and acres of land can as quickly be planted with it, as one man giving the ground one sharp blow with a *mamoti*, and followed by a woman carrying the grass, plant portions of it as they go along, and is sufficient for the roots to take hold. On the face of steep cutting, this grass is of great utility, in preventing the soils from further slipping or washing away. Cattle thrive equally well upon this grass, and only require but half the quantity.

HAY.

The much that has been said and written about the value of early-cut hay has unquestionably had its influence upon the practice of many, if not of all farmers. The current of opinion has been changed, and there are few who do not now hold, at least in theory, that early-cut hay is best, though some yet doubt its being, on the whole, the most profitable.

But no great step in advance can be taken in regard to a single matter without its being revealed that many other things must be made to keep step with it, in order that the expected benefit may be fully realized. The mowing machines called for smooth fields. The importation of improved domestic animals necessitated better housing, feeding and care. The new methods of setting milk for cream cannot yield their full advantage without more care in milking and in making butter. And so it is with regard to the early cutting of hay: before it can be put in practice with the surety of reaping all its advantages, we must abandon some old ideas and take in some new ones. We must cease to look upon the grass crop as a free gift of nature, and begin to regard it as a cultivated crop; one not to be stolen from the ground after a full yield of grain, but to be made a primary object in our culture the same as corn or potatoes.

The proper complement and conclusion of the theory of early cutting are that we must have two, and sometimes three, full crops of grass from the same land in one season. We can only get them by manuring and seeding for them. It is of no use to talk of early cutting and two crops upon land in such poor heart that the early quick-growing grasses, like June-grass and orchard-grass, cannot make a crop on it, where timothy, weak and scattering, does not get strength to head out before the middle of July. On such land we must wait for the grass to "thicken up," or we shall not be able to see it after the machine has passed over the field.

There are farmers who say that June-grass is worth nothing for hay, and we have seen farmers cutting it at the rate of two tons to the acre the first week in June. It would be a good thing to bring these two kinds of farmers together in a farmers' club, and have the latter tell the former how it was done. Orchard-grass and clover will usually be fit to cut about June 12, and all that is dry on the ground may be grown on it, if one knows how. Directly adjoining such a crop, with only a board fence between, on land equally good by nature, we have seen about six spears of timothy to the square foot struggling with sorrel, daisy and five-finger, all together making perhaps one-third of a ton of "good horse hay" to the acre about the last of July. It was of no use to talk to the owner of that field about early cutting, for there was nothing there to cut early.

In the good old times, before mowing machines, tedders and horse rakes, it would have been cruelty to talk about two or three hayings in one summer. But now that the handling of grass is reduced to so small an item, there is no difficulty about it, if we can raise the grass. Can we do it? Is it "all humbug" to talk about carrying a herd of 25 cows on the feed of a 50-acre farm? We know a practical dairyman who keeps that number on 25

acres, but he soils instead of pasturing them. There are thousands of farms better suited to dairying than his, yet we will not frighten our readers by proposing to them to stock up at the same rate. But we do think any of us might be smart enough to make 50 acres carry a herd of twenty-five, if we would only make a study of the subject. It will take manure to do it, and knowledge and skill as well.

No farmer that wastes all or half the liquid manure of his stables, will even make hay at the rate of four tons to the acre. Nor will he do it by the usual routine of seeding timothy and clover with grain. An old colored brother was once observed fishing from the long bridge at Washington, and throwing overboard everything he took except the bull-heads, or what they call cat fish. On being asked why he threw back the bass and other fish he answered: "Well, you see, boss, when I goes a-catting, I goes a-catting." We must be inspired with this old man's method, a little more intelligently applied, if we want to be eminently successful growers of grass. The objective point on all dairy and stock farms should be grass, and every process of the farm should have the grass crop in view above everything else. When we have learned how to grow four tons of hay in two or three cuttings, we shall all be "early cutters." and late cutters too. On moist meadows we shall still grow single crops of timothy, red-top and fowl-meadow grass; on all arable upland we shall learn the value of rye-hay, oat-hay and Hungarian, as well as of clover and of fodder corn properly grown for forage; while on our permanent mowings we shall learn what June-grass and orchard-grass can be made to do by the use of manure and primary seeding—that is, seeding without grain. There are lands of an intermediate character, moist and rich, yet well drained, naturally or by art, where two heavy crops of timothy may be cut every season. It is just as true that we go over too much ground for our grass, as that we do the same for other crops. But the change in either case is not so easily made. We do not exactly believe what we read about it; we have too few visible examples for our encouragement and instruction. Yet we ought to perseveringly experiment in this direction. Those of us, especially, who are perforce "small farmers" with our ten to fifty acres a piece, must try to learn how these things are done, and surprise our big neighbours with our big barns filled with big crops from small areas of ground.—*Rural New Yorker.*

THE TRADE OF BOMBAY.

IN Messrs. James Mackintosh and Co's annual Freight Circular for the year ending 30th June last, will be found much interesting information, of value both to merchants and to ship-owners concerned in the export trade of this port. Last year when noticing a similar statement made up to 30th June 1878, we had to remark upon a falling off in the principal articles of export. This year's return, we are sorry to say, paints a still blacker picture. Cotton shipments have dwindled down as follows:—

	Great Britain.	Continent.	Totals.
1875	... 842,712 Bales,	464,111 Bales,	1,306,823 Bales.
1876	... 576,170 „	420,078 „	996,248 „
1877	... 424,015 „	495,398 „	919,413 „
1878	... 297,179 „	415,143 „	712,322 „
1879	... 290,653 „	355,996 „	646,649 „

The total for this year it will thus be observed is less than that of last year by 65,673 bales. In 1875 the shipments reached 1,306,823 bales, so that in five years our cotton trade has decreased 50 per cent. That decrease is doubtless due in some measure to the reduced prices ruling for the staple during the past four years, but the main cause of the falling off is to be found in the adverse seasons we have had. Nor must the influence of exchange on exports be lost sight of. In 1876 the silver scare depressed the rupee to the lowest point ever reached, and as a necessary consequence the volume of our exports was largely increased. This presidency for the last three years has in many districts had to contend with drought and famine, but after making every allowance for these misfortunes, the falling-off in the production of cotton, and consequently, in the trade of the port, merits very serious attention. It may be suggested that a larger quantity of the staple is consumed by the local mills, but that will not apply to the present season, seeing that so many of these undertakings are closed through bankruptcy, and we doubt, therefore, if more than 25,000 bales were consumed locally during the year under notice than in 1875.

If we turn to the other leading articles of export, we meet with similar unsatisfactory results. Linseed shows a falling off of 652,840 cwts, as compared with last season. For in 1876 the exports of linseed were 2,527,228 cwts., and this year only 609,929 cwts. Rapeseed also shows a decrease of 108,270 cwts., as against the same period in 1878. In gingelly there is an increase of 115,668 cwts., and also in castor seeds of 70,310 cwts. The trade in wheat seems to have disappeared altogether, as will be seen from the last five years:—

1875	531,275 cwts.
1876	1,183,402 „
1877	974,060 „
1878	744,660 „
1879	20,924 „

The other item of myrabolanes shows a decrease of 98,545 cwts., as compared with the same period in 1878. These being the principal articles of bulk in which the ocean-carrying trade is interested, are the only ones dealt with in the paper under notice; but the figures shown are sufficient to demonstrate the sad decline that has taken place in the export trade of this port during the past year. Doubtless the season was an exceptionally bad one, but the falling off visible is so serious as to merit the careful consideration of both Government and the commercial community, to whose notice we recommend Messrs. Mackintosh and Co.'s compilation. In the meantime we can only hope that we have seen the last of unfavourable monsoons and unseasonable weather.—*Bombay Gazette.*

SOME FACTS ABOUT TASMANIA.

THE Colonial Secretary of Tasmania has been good enough to furnish us with the Statistical Report on that Colony for the year 1877. The report, compiled by Mr. E. C. Nowell, Government Statistician, has some interest for Anglo-Indians, a number of whom are either already settled in the colony, or contemplate retiring thither hereafter with the modest pension receivable from the Indian Government. The population of the island on the 31st December 1877 was 107,104, having increased during the year by about 1½ per cent. There are but few emigrants attracted to this colony just now, the number introduced under the "Bounty" system in 1877 being only 7. Then many young Tasmanians who cannot get employment in their own colony seek their fortunes in the other colonies. These causes combined have tended to check that rapid growth of population in Tasmania which may be observed in some of the neighbouring colonies. The welfare of the present population, however, seems to be steadily improving, and its consuming power, as exhibited in the import returns, has increased from £8-3-6¼ per head in 1869, to £13-3-11¾ in 1877. The articles in which the largest increase has occurred were spirits, wine, tea, sugar, cocoa, chocolate and tobacco. The total value of imports was £1,308,671; and of exports £1,416,975. Wool is the chief export, over 8,000,000 lbs., valued at some £525,000, having been sent from the colony in 1877. Tin now ranks second in the list of products, the value of the export in 1877 being nearly £300,000. As the export trade in this article only began in 1873, it is anticipated that there will be a large trade in the future. It is thought also that "iron will probably become one of the chief sources of wealth to this colony." Fruit occupies the third position in the list of exports. The trade in preserved fruits has doubled in the last ten years, the exports now reaching 3¼ millions of lbs., valued at £150,000. Besides preserved fruits, the colony exported in 1877 some 150,000 bushels of green fruits. The development of the fruit trade in Tasmania is perhaps the most practical illustration we can have of the superiority of its climate. It is only since 1870 that gold appears among the exports. There seems no doubt that quartz-mining will pay as well in Tasmania as it does on the Australian continent, and the fact that over £40,000 worth of gold was exported in 1876, and about £27,000 worth in 1877, would show that gold-mining is being steadily pursued as a colonial industry. A rich alluvial gold-field was discovered at Brandy Creek, on the river Tamar, from which some £25,000 worth of gold was obtained. The number of "miners' rights" issued in the year was over 1,500, and 1,000 men were engaged in gold-mining pursuits. The mining commissioner remarks: "Since the opening of the year, the discovery of gold has been reported to me at the following places; neighbourhood of Pieman's river, West coast; River Cam, North-West coast; vicinity of Sheffield, River Mersey; Mount Cameron in the North-East district, and Port Cygnet in the South. Little has yet been done at any of these places to test the value or the discoveries, but it is worthy of notice that the existence of gold has been discovered almost simultaneously at extreme ends of the island, and in every direction. I have every reason to believe the ensuing summer will witness more extensive prospecting operations than we have yet seen in the colony."

"The influence of most of our charitable institutions is, to my mind, calculated to foster or encourage a pauperising spirit to an extent which even tends to the corrupting of the industrious and frugal portions of the community. In making this remark I do not for a moment undervalue the necessity for these Institutions, or the benevolence which has called them forth,—nor do I wish to see them admininistered in a niggardly spirit, which would be a discredit to the Government,—nor do I forget that in a new country, where the population is so nomadic, and where the risk of accidental incapacity is greater than in older and more settled countries, there naturally falls to be a larger proportion of workers liable to become helpless and thus burdensome to the State: but these institutions should not be regarded beforehand as secure and attractive havens for the sensual and improvident who have earned no right to such provision; nor should they be made means by which persons who wish to avoid parental obligations, or the claims of consanguinity can shift their burdens on to the shoulders of the public. As regards the former abuse, some degree of work (however light it may be in character) should be apportioned to each inmate when practicable, for the double purpose of preventing idleness and of instilling a feeling that he is doing something towards self-maintenance; while as regards the latter, prompt search after, and punishment of all who desert those legally dependent on them should be made the rule. . . . . To intemperance, self-indulgence, and self-neglect, may in large measure b traced the sources whence flow the streams of our pauperism."

In contrast to these remarks about pauperism, it is interesting to note that depositors in Savings' Banks are steadily increasing, and numbered over 12,000, with deposits aggregating over £300,000, or averaging about £20 per head. Depositors with above £100 numbered 919; with from £50

to £100, 1,365; with from £10 to £50, 3,060; and with under £10, 7,[illegible]. Those who want to remit money to friends in England are [illegible] by the bugbear of low exchange, the rates for bills on London being only a fraction below par. The postal system in the Colony seems to work very well, seeing that 2,000,000 letters, 1,800,000 newspapers, and 100,000 packets were distributed during the year. It is suggestive too of the benefits conferred by the telegraph that a population of a little over 100,900 should send 67,355 messages "within Tasmania." and 12,644 messages "between Tasmania and other countries," during the year. The lines are still being extended, 370 miles of single wire line having been laid in 1877. The railway carried over 100,000 passengers, or a number equal to the whole population of the colony.

The acclimatisation of English fish in Tasmania has been completely successful. The "Salmon and Trout Breeding Establishment," we are told, "nearly paid its own expenses, £208-15 having been received during the year for fishing licenses and sale of ova." A return of the distribution of ova and fry from the Breeding Ponds on the river Plenty shows that 500 salmon trout ova, and 6,500 brown trout ova, were sent to Victoria, and 3,000 brown trout ova to New South Wales, while over 3,050 brown trout fry were distributed in the various rivers in Tasmania. By all accounts very fair fishing is now to be had in some of the Tasmanian rivers.

The demand for Crown Lands is increasing, and the price of land near towns is improving. The average price of country land in 1877 was £1-6-4½ per acre, and of town land £8-3-4½ per acre. Up to the end of 1877 there had been a little over 4,000,000 acres of land alienated, leaving about 12¼ million acres as the property of the State. The islands adjacent and belonging to Tasmania have been taken up a good deal of late years for pastoral purposes, and three-quarters of a million acres in these islands were rented from the Government in the year 1877. The total rental of Crown Lands in 1877 amounted to only £7,068, being at the rate of 12s. 9¼d. per 100 acres. During the same year there were granted to individuals under "immigration certificates" 314 acres, against 440 acres in 1876. There seems to be a tendency among the Tasmanian farmers to give up agriculture proper in favor of stock-keeping, the area under wheat, barley and oats cultivation showing a decrease. The same tendency is observable in Great Britain, where the acreage under wheat was 19 per cent. less in 1876 than in 1869. Scarcity of labour, and the high price of meat have brought about this state of things at home. "The scarcity or indifferent quality of labour is one of the principal difficulties experienced by the Tasmanian farmer; the second cause operates here also, although not in so great a degree as in the United Kingdom." The following figures, showing the average yield per acre, during the last ten years, of some of the principal crops, are suggestive of steady improvement in agriculture :—

	First, Quinquennium.	*Second, Quinquennium.*
Wheat, bushels	15·57	17·69
Barley, bushels	20·17	23·10
Oats, bushels	22·74	28·88
Potatoes, tons	3·49	3·34
Hay, tons	1·13	1·24
Hops, lbs.	1014	1313

The Statistical Officer remarks on these figures :—"If therefore less ground has been cropped, it has at least been better cultivated, and the use of machinery in farming operations seems to be more appreciated—the acreage of wheat reaped by machine in the past year having been returned at 20,000 against 6,496 in 1876-7, or more than three times as much." The use of machinery for farming purposes is everywhere largely increasing. In some districts a good deal of under-ground drainage is being carried on; in other parts open drains are cut, 13 feet wide by 5 feet deep. "In every instance where drainage is carried on, the land can carry double the complement of stock." The returns of live-stock in the island show about 2,000,000 sheep, 127,000 horned cattle, 22,000 horses, 56,000 pigs, and 2,000 goats. A general improvement is reported in the breed of stock.

The Statistical Officer calls prominent attention to the increased mortality of late from diseases like typhoid and diphtheria, and declares that the whole question of public health in towns requires to be vigorously attacked. The Health Officers consider that these diseases have been produced by the pollution of water, and that stringent measures are required for preserving the original purity of the rivers. The Statistical Officer suggests that Health Officers should be appointed throughout the settled districts, whose duty it would be, whenever any epidemic or preventible disease should appear, to investigate the causes, and call upon the local authorities to apply the proper remedy. On their failing to do so, the Government would defray the expenditure in the first instance, recouping itself afterwards by deducting the expenditure from any moneys payable to the district from the Treasury. The death-rate in 1877 was 19·19 per 1000, whereas the average rate between 1866 and 1873 was only 14·07 per, 1000. The birth-rate, on the other hand, was 30·21 per 1000. The marriage rate was 7·82 per 1000, "the highest for many years;" while there were three petitions for dissolution of marriage through the Divorce Court.

In conclusion the Statistical Officer remarks :—

"A review of these statistics as a whole, shows that during the past year the prospering of the colony was increasing. The value of its mineral productions was much greater; so also was the quantity of wool. The imports and exports, and the shipping employed, were larger in amount, the revenue more buoyant, wages and prices were higher, the number of paupers and criminals in the Government establishments was smaller, the capital in the banks was accumulating, the Crown lands were sold in larger quantity and for higher value, and produce also. By way of [illegible] more houses were built in the capital, and others [illegible]. Taking into consideration the depression which is so generally [illegible] over a great part of the world, both old and new, and the uncertainty [illegible] which prevailed during the year, the progress made must be considered a highly satisfactory. In the present year, 1878, the further advance in mining of various kinds which is taking place, and the late rise in the price of our staple commodity, wool, may be expected, when the time to deal with the statistics of 1878 arrives, to have produced a still more favourable effect."

THE FLAX SUPPLY.

WE have received the twelfth annual report of the Flax Supply Association for the improvement of the culture of flax in Ireland, from which we extract a few details about our own and other countries. The acreage under flax in Ireland last year was 111,808 acres, being 11,572 acres, less than in 1877. The diminution in the area was caused by a deficiency in the supply of seed—more would been sown had seed been available. The imports of seed were 192,654 bushels. The Riga seed is imported in barrels of 3½ bushels, and sold at 45s. per barrel; the Dutch in hogsheads of 7 bushels at 95s. per hogshead; the English was sold at 85s. per quarter. All the prices were in advance of the previous year. The average yield of flax per acre in 1878 was 31·15 stones of 14lbs. per acre.

In the following summary the most recent acreage is given, and the estimate of production in the various European flax-producing countries is based, where practicable, upon average yields, and where no data exists a moderate yield is assumed :—

		Statute Acres.		Stones.		Tons.
Austria ...	164,200 Jochs,* or	283,104	at	21·48	per acre	31,302
Belgium ...	57,045 Hectares,† or	140,901	,,	33·59	,,	29,580
Denmark ...		17,686	,,	20·00	,,	2,211
Egypt ...		15,000	,,	20·00	,,	1,875
France ...	78,774 Hectares,† or	194,571	,,	34·84	,,	42,368
Germany ...	214,835 ,,	530,642	,,	22·50	,,	74,621
Greece ...		957	,,	20·00	,,	119
Great Britain ...		7,261	,,	31·15	,,	1,414
Hungary ...	17,527 Jochs,* or	24,888	,,	20·00	,,	3,111
Holland ...	20,472 Hectares,† or	50,564	,,	31·77	,,	10,040
Italy ...	81,386 ,,	201,028	,,	18·14	,,	22,791
Ireland ...		111,808	,,	31·15	,,	21,768
Russia ...		1,928,568	,,	20·00	,,	241,071
Sweden ...		37,500	,,	20·00	,,	4,688
		3,494,533				486,959

—*Journal of Applied Science.*

* Joch = 1·43 Imp. acre.
† Hectare = 2·47 do.

FARMING IN SCOTLAND.

FOR weeks past the gossip current at the weekly markets throughout the Lothians and elsewhere has, for the most part, had reference to events of very unpleasant significance to farmers. While this is to be regretted, there are, however, not wanting signs to indicate that agriculturists are beginning to profit by the lessons the losses of recent years have taught them. The sequestration of a tenant after a few seasons' occupancy is, no doubt, an apparent misfortune; but when it is found that the lease now cut short was begun with capital ridiculously insufficient—not one-half of what ought to have been in hands—little sympathy need be expressed for the man who has thrown away his own few hundreds, along with many other hundreds belonging to other people. Then in the land market the former inflation is disappearing; offerers, instead of rushing into reckless competition, are rather vying with one another in caution.

In rent reduction, two most notable arrangements have recently been made—the one in East-Lothian and the other in Perthshire. In the former district, the farm is one for which £1,400 was refused several years ago, owing, it was understood, to the keen desire of the proprietor for game preservation; and now it has been let at £900, with the further concession of a year's rent-free occupancy to start with. The Perthshire report is equally significant, as in that case the rent has fallen £400 on one of the very best farms in the Carse of Gowrie, and the in-going tenant has also the promise that in four years twenty acres will be added to his holding without any increase of rental—a condition which makes the fall equal to about 40 per cent. When terms of this kind have been secured, it is, of course, not to be thought that the new leases can imply unreasonable risk to the tenants. But, on the other hand, there are many agriculturists who, in view, as they point out, of the unstable character of the circumstances surrounding their profession, have declined to bind themselves to nineteen years' tenure. Whether or not they are wrong in departing from the prevailing system, need not in the meantime be discussed. On a property in Perthshire—one of the best managed in the country—two farms have been let with no leases, but on the understanding that nine months' notice to quit be given on either side, with compensation for unexhausted improvements, at rents 16½ and 18½ per cent. below those previously paid. Then again, in Fifeshire, where a large number of holdings are at present in the market, several of them without attracting the slighest notice, a similar practice has been adopted. One farm, for example, near Thornton, has been retaken by the present occupant at a reduction of £180 for a six years'

loss. Another holding, not far from [illegible], [illegible], has been secured [illegible] the former rental, with considerable improvements to be made by the proprietor, and here again the lease is only for six years. Whatever [illegible] of these short leases, this much may be said for them—that they are not likely to allow time for an accumulation of debt such as has just come to light in this county in the case of a sequestrated tenant who, in a rental of about £1,500, is stated to be £6,000 in arrears to the landlord.

When failures of this startling kind are heard of, questions are naturally suggested as to what the profits of farming really are, seeing that one or two bad years lead to complications so very hopeless. To help those who are not themselves practically acquainted with agriculture, we may quote the statement of a practical farmer, as to the working of an average-sized farm in an average year. It must be taken for what it is worth and doubtless in some respects it may be called in question. Taking the case of a 300-acre farm situated, say, in the middle district of East Lothian, with entry at Martinmas, and the rent payable in a year's time there has first to be found at least £4,300 of capital, apportioned thus :—

		£	s.	d.
10 horses, with harness, carts, ploughs, &c.	...	£1,000	0	0
Threshing machine, barn implements, &c.	...	150	0	0
Manure—paid to outgoing tenant ...	...	100	0	0
Manure, seed, labour, tradesmen's accounts, &c.	...	1,909	0	0
50 cattle in October, to put on turnips, at £15	...	750	0	0
Reaping machines, turnip and hay-cutters, cake and corn-bruisers	...	100	0	0
Required for exigencies	...	300	0	0
		£4,309	0	0

In an unusually satisfactory year, with all the crops good, the income and expenditure in this farm, taking the prices as indicated by the fiars for the last eight years, excluding 1872 and 1877, would be :—

PRODUCE.

		£	s.	d.
50 acres grass, at £7	...	£350	0	0
50 acres oats—6 qrs. at £1-9s.-6d. ...	...	442	10	0
40 acres wheat—5½ qrs. at £2-11s. ...	...	560	10	0
60 acres barley—6½ qrs. at £1-19s. ...	...	760	10	0
50 acres potatoes, at £22	...	1,100	0	0
50 acres turnips, at £8	...	400	0	0
Foggage	...	50	0	0
Total produce	...	£3,663	10	0

EXPENDITURE.

		£	s.	d.
300 acres rent, at £2-12s.	...	£780	0	0
Interest, 5 per cent. on capital ...	...	215	0	0
Remuneration for management (exclusive of value of house)	...	200	0	0
50 acres grass seeds, at 16s. per acre ...	...	40	0	0
50 acres oats seeds, at 14s.	...	35	0	0
40 acres wheat seeds, at £1	...	40	0	0
60 acres barley seeds, at 15s. ...	...	45	0	0
50 acres potatoes, at £3	...	150	0	0
50 acres turnips, at 3s.	...	7	10	0
Keep of 10 horses, at 13s. per week ...	...	338	0	0
8 men, at £46	...	368	0	0
8 workers, at 9s. per week, for 44 weeks	...	158	8	0
Extra labourers	...	60	0	0
Harvesting	...	70	0	0
Manure for hay, at 16s. per acre ...	...	40	0	0
Manure for oats, at £1-5s. per acre ...	...	62	10	0
Manure for wheat, at £1	...	40	0	0
Manure for potatoes, at £3-10s. per acre	...	175	0	0
Manure for turnips, at £3-10s. per acre	...	175	0	0
Tradesmen's accounts	...	45	0	0
Railways and marketing expenses, and coal for engine	...	30	0	0
Depreciation of horses and implements	...	80	0	0
Taxes	...	30	0	0
Gig and boy	...	50	0	0
		£3,234	8	0
Surplus of profit	...	£420	0	0

This is not much, but if our authority may be trusted, it is too much. He puts it that the profit thus stated is on the best years, and he says that even in a fair average year the balance of surplus profit would be almost nowhere ; for if, in place of the white crops reckoned upon, there be substituted :—

		£	s.	d.
50 acres oats, 5 qrs. at 28s.	...	£350	0	0
40 acres wheat, 5 qrs. at 44s. ...	...	440	0	0
60 acres barley, 6 qrs. at 35s. ...	...	630	0	0
In all	...	£1,420	0	0

the income is reduced to the extent of £344. Of course if the prices be taken still lower, the profit will disappear. Dealing with 1872 and 1877, the following figures are given :—

PRODUCE IN 1872.

		£	s.	d.
50 acres grass at £7	...	£350	0	0
50 acres oats, 5 qrs. at £1-[illegible] ...	...	359	7	6
40 acres wheat, 3½ qrs. at £1-17s.-10d. ...	...	264	18	6
60 acres barley, 5 qrs. at £1-[illegible] ...	...	490	0	0
50 acres potatoes at £5	...	250	0	0
50 acres turnips at £8	...	400	0	0
Foggage	...	50	0	0
Total	...	£2,164	4	2

		£	s.	d.
Expenditure on farm, including remuneration for management	...	£3,234	0	0
Deduct produce	...	2,164	0	0
Deficiency	...	£1,070	0	0

PRODUCE OF 1877.

		£	s.	d.
50 acres grass at £7	...	£350	0	0
50 acres oats, 5½ qrs. at £1-10s. ...	...	412	0	0
40 acres wheat, 2½ qrs. at £2-6s.-7d. ...	...	232	18	4
60 acres barley, 3 qrs. at £1-15s.-6d ...	...	319	10	0
50 acres potatoes at £10	...	500	0	0
50 acres turnips at £6-10s.	...	325	0	0
Foggage	...	50	0	0
Total	...	£2,189	18	4

		£	s.	d.
Expenditure	...	£3,234	0	0
Deduct crop	...	2,189	0	0
Deficiency	...	£1,045	0	0

Everybody must wonder when they see figures like these how farmers contrive to live. But the pessimists have more to say. They refer to the results alleged to be obtained by farmers in Linlithgowshire, where the system of husbandry is quite different from that in East-Lothian—the rotation there being the five in place of the six shift. On some farms in this district two years' grass is taken, on others a hay crop is raised instead; but as there is almost no monetary difference in the returns, preference may be given to hay in order to simplify the figures. On a good 300 acre farm in this county, then, employing only the very moderate capital of £3,000, the produce in a good year as estimated, like the other, by an agriculturist of practical experience, is :—

		£	s.	d.
75 acres hay at £8	...	£800	0	0
75 acres oats at £7	...	525	0	0
75 acres barley (or wheat) at £11-8s. ...	...	855	0	0
50 acres turnips, £8	...	400	0	0
25 acres potatoes, £25	...	625	0	0
Foggage	...	100	0	0
Total	...	£3,105	0	0

EXPENDITURE.

		£	s.	d.
Rent, £2-8s.	...	£720	0	0
Interest on capital, 5 per cent... ...	...	150	0	0
Remuneration for management (excluding value of house)	...	£150	0	0
Seeds—white crops	...	172	10	0
Turnips	...	12	10	0
Potatoes	...	68	10	0
Horses, 4½ pairs	...	257	8	0
7½ men	...	337	10	0
Outworkers	...	109	4	0
Outworkers, turnips	...	25	0	0
Harvesting	...	75	0	0
Manures, top-dressing	...	322	10	0
„ turnips and potatoes ...	...	300	0	0
Smith, wright, and saddler	...	50	0	0
Taxes	...	25	0	0
Gig	...	50	0	0
Depreciation, ...	...	80	0	0
Marketing	...	25	0	0
		£2,930	2	0

		£	s.	d.
Total Produce	...	£3,105	0	0
Expenditure	...	2,930	0	0
Balance of Profit	...	£175	0	0

For 1872 and 1877 the figures are :—

PRODUCE OF 1872.

		£	s.	d.
75 acres hay at £6	...	£450	0	0
75 acres oats at £4	...	300	0	0
75 acres barley at £5-8s.	...	405	0	0
50 acres turnips at £6	...	300	0	0
25 acres potatoes at £11	...	100	0	0
Foggage	...	100	0	0
Total	...	£1,655	0	0

Expenditure	...	...	£2,930 0 0
Deduct crop	...	...	1,655 0 0
Deficiency	...	...	£1,275 0 0

PRODUCE OF 1877.

75 acres hay at £6	...	...	£450 0 0
75 acres oats at £7	...	...	525 0 0
75 acres barley at £5.8s	...	...	405 0 0
50 acres turnips at £8	...	...	400 0 0
25 acres potatoes at £8	...	...	200 0 0
Foggage	...	...	100 0 0
Total	...	...	£2,080 0 0
Expenditure	...	...	£2,930 0 0
Deduct crop	...	...	2,080 0 0
Deficiency	...	...	£850 0 0

These figures are given because they represent the case which some farmers desire to put forward; but that they under-rate the profits of good years, and probably also exaggerate the losses of bad years, cannot be doubted, unless farmers live on nothing, and take pleasure in throwing away their capital.

How the conditions attending agriculture vary, necessitating the frequent reconsideration by the farmer of the circumstances attaching to his position, is indicated very strikingly by the statistics showing the growth of the import trade in foreign cattle and grain within recent years. Between the years 1868 and 1878, the development of every branch of this trade was very great, as these figures show :—

	1868.	1878.
Live cattle, sheep, and pigs, ...	£2,698,496	£6,012,564
Corn, grain, and flour ...	39,432,624	63,536,322
Dead meat, bacon, cheese, provisions ...	13,277,683	30,144,013
	£55,408,803	£99,692,899

Then, again, the number of live stock brought across from the United States and Canada into the United Kingdom was as follows :—

	1877.	1878.	Increase.
Cattle	19,187	86,589	67,402
Sheep	23,395	84,076	60,681
Pigs	810	17,935	17,125
Total ...	43,392	88,690	135,208

There is in these figures material for serious consideration by farmers though there is nothing to create discouragement. A fresh adaptation of means to end will no doubt be as necessary in farming as in other businesses; but that agriculture will recover from its temporary depression, and be even more prosperous in the future than it has been in the past, need not be doubted.—*Scotsman.*

CATTLE DISEASE IN THE PUNJAB.

OWING to the outbreak of cattle disease in many parts of the Punjab, a set of rules for its treatment, and a memo. of the symptoms of the two kinds of cattle disease, rinderpest, *taka* or *zamat*, and foot and mouth disease, *mukhkhur*, drawn up by Veterinary Surgeon Queripel, have been circulated in English and Vernacular, for general information. In order to ensure speedy notice of the appearance of cattle disease being given to the Deputy Commissioner, a reward of Rs. 5 is offered to the person who first brings the intelligence; and a piece of ground outside the village, where the case appears is to be at once set apart and all affected animals sent there and one or more men according to the number of diseased animals employed solely to tend them. On the death of an animal suffering from disease, the carcase is to be buried at a depth of four feet, the hide having been previously so cut as to be valueless. The treatment of rinderpest recommended is a mixture of gruel, chiretta and country wine, when the animal is in a weak state, and *suttoo* gruel, instead of water, as much as it can be got to drink. In *mukhkhur*, or foot and mouth disease, the mouth should be washed with weak vinegar and water; or when ulcers have formed dressed with alum lotion; the feet being kept perfectly dry, and any ulcers present, dressed with powdered alum. A mixture of 8 oz Epsom salt, 2 oz. nitre and a pint of gruel should be given when the animal is first seen to be suffering. In both diseases scrupulous cleanliness is required.

The symptoms of rinderpest are described as follows :—Horns and extremities at times hot, at other cold; signs of weakness and fatigue; ears drooping, shivering, great thirst, suspension of rumination; loss of appetite, discharge from the eyes and nostrils. This stage is followed by diarrhoea, the fæces being much mixed with mucus, and times with blood; when the animal thus affected soon dies. The time between the outbreak of the disease and the death of the animal is about six days. The virus of this disease is of the most subtle kind, and may be communicated by actual contract, or be carried by the air, so that the greatest care is necessary to prevent contagion.

The symptoms of foot and mouth disease vary from those of cattle plague (rinderpest), and are easily recognizable. The affected cattle have the usual febrile symptoms, accompanied by slight constipation; and if in milch cows, the secretion of milk is at first diminished, and becomes gradually suspended. This is followed by eruptions in the mouth, like blisters, which break, leaving unhealthy ulcers; and may appear on the udder also. When the feet are affected, the coronets are first noticed to be hot, and the animals fall lame, and the same class of eruption appears in various parts of the foot.

The fact of the cattle of a village being infected has to be proclaimed to all surrounding villages, and every endeavour made to prevent the spread of the disease; while any person neglecting to take reasonable precautions is liable to prosecution for nuisance under the Indian Penal Code.

THE VINE.

IT has been estimated that the State of California has 15,000,000 acres of land adapted to the growth of the vine, but that less than 50,000 of this vast area are as yet planted. The average number of vines set out per acre is about 900, which gives an average yield of 100 gallons of wine and 120 of brandy when in full bearing. The progressive advance of the industry is shewn by the fact that the number of gallons made in 1859 was 100,000; in 1869, 500,000; in 1872, 3,000,000; in 1875, 7,000,000; in 1876, 10,000,000.

THE WEATHER, THE CROPS AND THE BUNIAHS.

WHATEVER theorists may have to say upon the influence of forests upon rainfall, and the decrease in moisture which follows upon a country being denuded of its standing timber, the steady downpour which Northern India has had for days back and continues to have, would seem to indicate that other causes operate to produce years of scant rainfall in tropical countries. Be that as it may, the rain we are now having is almost as unprecedented as the drought of a couple of years ago, and there seems a possibility of our yet having too much of a very good thing. The cultivators, nevertheless, are not just yet particularly loud in their complaints of a present surplus of moisture for the land, as they hope for a break in the course of a few days now, and if such should be the case, all will be well with our agriculturists. In the meanwhile grain continues to rise in value, and the *buniahs* explain the hardening of the market as due to the fact that they are unable, owing to the rainfall, to get their supplies in from the country. Of a verity, these harpies are never lacking an excuse for playing ducks and drakes with the sparse funds of the poorer classes of the population, and it is little wonder that the people should look back with fond regret to the days when Lucknow had such a city magistrate as Chamberlain to check the rapacity of these were-wolves of the city, and who allowed no petty politico-economic ideas about Free Trade in grain to be put forward as pleas for impoverishing the working classes. There is a necessity for a well-ordered *nerrick* for the city quite as much as for the cantonment; and if it is found requisite to fix the prices of grain, &c., in the Sudder Bazaar, assuredly it is equally necessary to impose some limit upon the extortions of the grain dealers who have their haunts in our crowded native town. We commend the subject to the attention of our Municipal authorities.—*Lucknow Times.*

METEOROLOGY IN THE N.-W. P.

ONE of the most marked characteristics of Indian meteorology is the regularity with which the rains commence and end. At Bombay in three years out of four the monsoon rains begin on the 4th or 5th of June. Inland the regularity is less pronounced, yet in the North-West the uniform sequence of the seasons is very striking. The winter rains begin about the 22nd of December in the north-westerly districts and a day or two later in the south-eastern. The odds are exactly even, that in any given year, these rains will begin between the 20th December and the end of the month. The mean of the commencement of the monsoon rains is from the 14th to the 16th of June; the extreme range being from the 30th May in Goruckpore, to the 9th of July in Bareilly; the mean of their close is, in different districts, from the 27th of September to the 3rd of October.

The causes of these periodical changes are now pretty thoroughly understood. At the end October and throughout November, the atmosphere all over Northern India, is very nearly in a condition of statical equilibrium; calms or light winds prevail in November and there are slight daily fluctuations of the barometric tide. In December the wind-velocity and the barometric oscillations increase; towards the end of the month the barometer falls for several days, easterly winds set in over the Gangetic valley, clouds form, and rain begins, first generally in the Punjab, and then in an eastward direction as far as Behar, Bengal, and sometimes Assam. This phenomenon is believed to arise from the moisture brought up by the south-west current, which flows at this

time above, and in the opposite direction to the north-east trade-wind which is the characteristic lower current of the period. An ascensional movement of the atmosphere takes place, resulting in cloud and rainfall, followed by an indraught which mainly takes the form of an easterly wind blowing up the valley of the Ganges. The old theory that these rains were simply the result of the condensation of aqueous vapour, owing to the prevalent low temperature, is disproved by the fact that in the Punjab the greatest rain precipitation takes place in March, whereas the coldest month is January. Mr. Hill considers that the easterly winds at this time prevalent in the Gangetic valley are due to the descent of a portion of the upper equatorial current, in a region south of the Ganges. The subsequent progress northward of this current is arrested by the Himalayas, an ascensional movement ensues and hence precipitation.

As the temperature rises in March and April, hot north-westerly winds blow with increasing velocity down the valley of the Ganges, reaching their maximum strength in the early hours of the afternoon, and dying away at sunset. The barometer falls generally, most of all in the Punjab and Rajpootana, till at last the unusual phenomenon is presented of wind blowing from a region lower to one of higher pressure. As the period for the monsoon draws near, a remarkable change in the barometric pressure all over the continent takes place. During the winter the pressure is greatest in the Punjab and decreases uniformly southward towards the equator. During the approach of the hot weather, the pressure decreases more rapidly on land than at sea. There is consequently in April a ridge of high pressure stretching across the Bay of Bengal and the southern portions of the Peninsula. As the season advances, this high ridge moves rapidly southward; at last about the middle of May, the area of high pressure retreats from the centre of the Bay towards the equator, and there is then an uniform slope of pressure, in other words, a baric gradient, extending from the tropic of Capricorn to the Himalayas. This sets in motion towards southern Asia a broad deep current of atmosphere, which, blowing over a large area of warm sea, reaches India, highly charged with moisture, and becomes the south-west monsoon. One portion strikes the western ghats, and forces its way up the valleys of the Taptee and Nerbuddah; another strikes Burmah and streams up the Bay of Bengal, and as it reaches the north is deflected partly by the valley of the Ganges and partly by the mountains, until, in the Punjab, it sometimes appears as a north-east wind. All important as this current is to Upper India, it is nevertheless a mere minor eddy of the great south-westerly current, and is, accordingly, Mr. Hill observes, especially liable to be disturbed by small, and apparently, quite insignificant variations of barometric pressure. A ridge of high pressure extending from Goojerat to Orissa was, it is now believed, the immediate cause of the disastrous monsoon of 1877.

The rains begin in Ceylon, the extreme south of India and Burmah, in the last week of May. They advance rapidly along the coast, reaching Bombay the first, and Calcutta the second week in June; inland their commencement depends on the rate at which the dry atmosphere becomes sufficiently saturated to allow of precipitation. Rain then continues at frequent intervals till the retreat of the sun southward, in the autumnal equinox, produces a rapid lowering of the temperature, and a weakening of the monsoon current which dies away gradually towards the end of September. By the middle of October the rains have ceased, the sky is clear, and the season of calm winds and uniform pressure has again come round.

As to the sun-spot and cyclical theory of monsoons. Mr. Hill considers that as regards Upper India no distinct relation between sun-spots and the summer monsoon can be traced; but that there is evidence of some connection between sun-spot and the winter rains, these rains being heaviest a year or two before the sun-spot minimum. The natural explanation of this would be, that in years of minimum sun-spots the heat is greatest, the consequent evaporation excessive, and that the water thus evaporated is carried northward, and falls during the winter months. Why the same result is not produced on the Madras monsoon, our present knowledge does not enable us to say. It is evident at any rate, that the rainfall of upper India is governed by laws altogether independent of sun-spots; if the four great droughts, two, those namely of 1803-4 and 1877-8 occurred in years of minimum sun-spots; the other two, those of 1837-8 and 1860-1 in maximum years. Mr. Eliot has pointed out that the atmosphere and rainfall of the N.-W.P. are in all probability more dependent on the amount of the Himalayan snow-deposit than on any other and remoter cause.—*Civil and Military Gazette.*

AGRI-HORTICULTURAL SOCIETY OF INDIA.

THE usual Monthly General Meeting was held on Friday, the 27th of June 1879.

Rajah Suttyanund Ghosal Bahadoor, Vice President, in the Chair.

The proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members :—

Captain A. Evans Gordon, Superintendent Government Horticultural Garden, Lucknow; Manager of the Awa Estate, Agra district; Messrs. A. B. L. Webb and H. Myer; Lieut.-Col. W. B. Thomson, and Dr. A. E. Dalgairns.

The names of the following gentlemen were submitted for membership :—

H. P. Rushton, Esq., Calcutta,—proposed by Mr. H. J. Leitch seconded by Mr. R. Blechynden.

G. R. Abergh-Mackay, Esq., Principal Residency College, Indore,—proposed by the Secretary, seconded by Mr. W. Waterfield.

Mr. Sorabji Dadabhoy Patell, Mhow,—proposed by the Secretary, seconded by Dr. S. Lynch.

Alfred C. Brett, Esq., C.S., Jessore,—proposed by the President, seconded by Mr. S. H. Robinson.

J. B. Woosman, Esq., Cinnamara Tea Garden, Jorehaut,—proposed by Mr. St. George A. Showers, seconded by the Secretary.

J. C. Grieff, Esq., Ranikhet,—proposed by the Secretary, seconded by Mr. J. Caldwell.

Rejoined.—Lieut.-Col. A. E. Campbell, Deputy Commissioner Sibsaugor, Assam, and W. G. Conroy, Esq., Calcutta.

The following gentlemen were proposed, on the recommendation of the Council, as Honorary Members :—

Lieut.-General Sir A.P. Phayre, G.C.M.G.; K.C.S.I.; C.B.; and Baron Ferdinand von Mueller, C.M.G., M.D.; PH.D., F.R.S., Government Botanist for Victoria.

CONTRIBUTIONS.

Seed and seedlings of Sâl, of Casuarina, and Ravenala.—From Superintendent, Royal Botanic Garden, Calcutta.

A further supply of seeds of timber, and other trees from the Andamans.—From Mr. E. H. Man.

Seed of acclimatized Balsam and Reana luxurians.—From Mr. W. G. Amos.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following papers and letters were submitted :—

1. From C. H. Brookes, Esq.,—Notes on Tea-planting in the Andamans, accompanied by specimens of tea manufactured therefrom, with report thereon by Messrs. W. Moran & Co.

2. From the Secretary,—Further Notes on Bamia cotton, with specimen from his garden; and report thereon by Messrs. W. Haworth & Co.

3. From J. E. O'Conor, Esq.,—A Note regarding Manilla hemp, with specimens raised on the Andamans and at Vytori; and report thereon by Mr. John Stalkartt.

4. From J. E. O'Conor, Esq.,—A Paper on the cultivation of the Ground-nut in India.

The above four papers were transferred for publication in the journal.

5. From G. F. Pinney, Esq., submitting for report and valuation a specimen of an indigenous tea. Messrs. Moran report, "that this tea appears to have been made from a peculiar variety of the tea plant, but from any samples we have seen at present, we should think that it would not find favour in the London market. The liquor is not only very pale in colour, but is without the flavour and rich strength of the usual article of commerce. As regards the appearance of the leaf, the tip is entirely different from anything yet produced, and speaking of this tea generally, we have no means of saying how it is likely to be received by consumers."

The Secretary remarked that he had requested Mr. Pinney to send leaves of the plant from which this specimen has been manufactured with the view of identifying it.

6. From G. F. Pinney, Esq., specimen of a blight which is new to him.—(Referred to Mr. Moore of the Indian Museum).

7. From G. F. Mewburn, Esq., details of the result of manure on a tea garden.—(Transferred for Journal with other papers on same subject).

8. From Captain J. F. Pogson, regarding a pumpkin of enormous growth and weight.—"The information alluded to in my previous letter," observes Captain Pogson, "is now given more in detail. I think the Society might take up the subject with great advantage to the people of India. A squash of 200lb. would be food for 200 men for one day, and it would also answer for cattle food. The seeds are white and large, very like the Californian pumpkin seed you sent me in 1871 at Kussowlee, only they are larger. I hope my trial will be a success, and if so, the very largest pumpkin will be reserved for you."

The following is extract of the Rev. Mr. Carleton's letter to the Rev. W. Rebsch, Kotegurh :—

"I send squash seeds. They come from Chili, South America, and on the Pacific Coast; they are of 250 pounds weight. In a dry climate they grow to enormous size,—under scientific cultivation, one thousand pounds. I hope to produce one in four months of at least 200lbs. Tell Captain Pogson to sow it in light rich loam 2 to 3 feet deep, the root will go down 3 feet deep, and as big as a man's arm."

9. From E. Buck, Esq., Director, Department of Agriculture, &c., N.-W. Provinces, applying for certain kinds of American maize suitable for cooler latitudes.

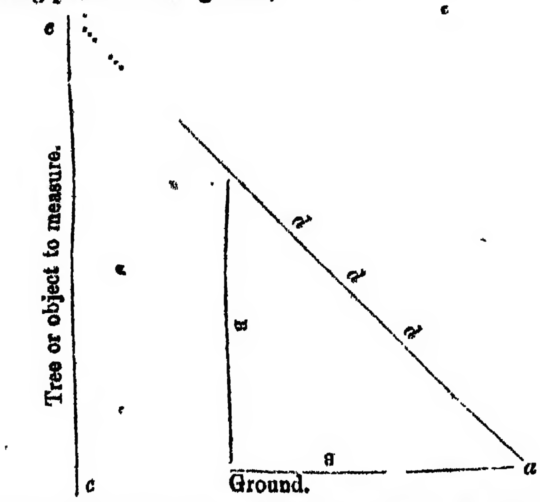
10. From J. E. O'Conor, Esq., Government of India, Department of Agriculture, applying for Egyptian cotton and acclimatized Russian flax seed for trial in the Arakan Hill Tracts.

The Secretary stated that steps had been taken to meet the above applications.

11. From Secretary, Agricultural and Horticultural Society, Madras, and Superintendent, Botanic Garden, Hong-Kong, returning thanks for journals and proceedings of the Society.

MEASURING THE HEIGHTS OF TREES.

THINKING it might be useful to some of your readers I send you a simple sketch for measuring tall trees or other objects. There are several ways of measuring trees, but the plan submitted will enable any one to measure them without damage to the trees. Take three laths, the same as bricklayers use for tiling, and nail them in the shape of the frame; B B must be of equal length; B and *a* being placed on the ground,



the eye must follow up the longer lath (*d*, *d*, *d*) until it is in a line with *e*, the top of the tree or object you wish to measure. The frame must be placed as level with the bottom of the tree as possible. Should the ground be very uneven you must give and take accordingly. You will see that *a* to *c* is the same length as *c* to *e*, and thus the height of the tree is obtained.—E. COVENEY, in *Journal of Horticulture.*

THE GARDEN.

IN 1877 there were 13,097 acres of fruit land in Kent, according to the *Agricultural Returns*, while in the last year the Returns show that there were only 11,589 acres, or a decrease of 1,408 acres. This, says the *Agricultural Gazette*, is most remarkable, and it is believed to be incorrect, as the tendency has been towards a steady increase in the acreage of fruit land in all parts of Kent during the past few years, and there is not the slightest doubt that there is more land planted with fruit trees at this present time than there ever was before in the county. There must be a great mistake somewhere, either on the part of those who made the returns, or of those who compiled them, as every one who knows what is going on, and has been going on lately in the agricultural world of Kent must be aware that there has been a great demand for fruit trees of all kinds, and that planting has been done in all directions, especially in West Kent, East Kent, and Mid Kent. All the other important fruit-growing counties, *viz.*, Devon, Gloucester, Hereford, Somerset, and Worcester, have kept their fruit acreage pretty much the same in 1878 as in 1877, and the fruit acreage of England was rather larger in 1878 than in 1877, or 161,222 acres in the former, against 159,095 acres in the latter year. There has also been every inducement to plant fruit in Kent. Hop cultivation has been most unprofitable of late, and the price obtained for fruit has been fairly good and remunerative upon the whole.

HOME FRUIT PROSPECTS.

THE season is a late one,—so late that there is no likelihood of frost occurring to damage the blossom or the newly set fruits. The blossom has been most abundant, and everywhere it appears to have been exempted from any of those sharp, sudden frosts which so frequently assail it at the most critical time. Gooseberries, it is true, in some parts, particularly in Ayrshire, and in some of the northern counties, suffered complete or very considerable destruction by the frost in May; but other fruits appeared at the time to suffer no check whatever, being still in the bud; so that there appeared every ground for hoping that the very unusually rich blossoming which followed on apples and pears would be succeeded by a plentiful set of healthy fruit. But from what we have ourselves observed, and from accounts which have reached us from different parts of England, as well as of Scotland, ultimate experience is not likely to be so happy. Great consternation is overtaking the large growers in the great fruit districts of England, from the dropping of the young pears and apples—especially the pears—from the trees to such an extent as to threaten to denude the trees of crop altogether. The same evil threatens in Scotland, and arises from the same cause, which is probably a too much prolonged period of semi-excitement during the time prior to opening the blossoms. Alternations of excitement, and checks to the consequent partial action induced thereby, are as destructive as actual frost when they are often repeated during the preceding stage of development towards flowering. An unhealthy elaboration and assimilation of juices stored up in the buds will induce vital weakness, and an imperfection of parts, which is certain to end in a thin crop; and we fear this is to be the experience of the present year, notwithstanding the splendid prospects that appeared to be certain to follow such a late and abundant show of blossom. Genial weather, if it comes soon, may do much to retain the fruit that still remains on trees; but a prolongation of the cold weather and superabundant wet which we have had for some time, will complete the effects of stagnation already too evident in the weakly, dropping fruit.

A FARMER wanted to borrow a gun from a neighbour to kill some yellow birds in his field of wheat, which were eating the grain. His neighbour declined to lend the gun for he thought the birds useful. In order to satisfy his curiosity he shot one of them opened his craw, and found in it two hundred weevils and four grains of wheat and these four grains the weevil had burrowed. This was a most instructive lesson, and worth the life of the poor bird, valuable as it was.—*American Paper.*

MAGNOLIA trees succeed well if planted at the same time with evergreens.

—Water lilies have been known to give as many as sixteen flowers from a single root.

—As the pinks begin to form buds, watch them to prevent their bursting open at the sides, which completely spoils their form. This is a habit of some of the very best varieties. A light wire bound around the bundle in the proper place will prevent the mischief.

—Western people are being fooled again by agents who pretend to have succeeded in producing a blue rose. Of course it is a fraud. Mr. Vick, commenting on the credulity of the people and their avidity for a blue rose, remarks that the species of plants that give yellow flowers seldom give blue, a law which is strikingly violated in the case of the pansy.—*American Paper.*

A FEW SELECT TUBEROUS BEGONIAS.

THIS class of begonia is attracting a great deal of attention at the present time, and they merit all the attention they get, for they are without doubt the most beautiful class of summer flowering greenhouse plants that has been introduced in recent years. They differ from the older classes of flowering begonias in being tuberous rooted. The stems being merely of annual growth, and quite herbaceous, die down at the end of the season; and the tuberous roots lie dormant, like those of the dahlia or potato, till spring, when growth recommences. They differ also from the class of ornamental leaved begonias, in being essentially ornamental flowered plants; and from both these great classes they further differ, in being greenhouse plants—all but hardy, indeed—whereas the others require more or less of stove heat; so that independently of their great beauty, they are plants well adapted to the wants of those who have only the facilities that a greenhouse affords for the culture of flowering plants. They are extremely floriferous; and their flowering period extends from spring or early summer till late autumn. But in order to have them in perfection for so long a period, they require most liberal treatment. Fortunately this is easily attained, for their wants are simple in the extreme. A rich, light soil, abundant in fibre or in partially decomposed manure, used while potting in the roughest and openest condition, and dry, so that when compressed in the palm of the hand it will not become hard and soiled, but break up into fragments when dropped upon the potting bench. The soil must not be rammed very hard into the pots. The roots like an open, very porous soil to ramify in. Thorough drainage is essential to their well-being. When growing freely, they want ample supplies of water at the roots; but when they begin to decline, they must be gradually dried off, by withholding water by degrees till the stems fall away, which they eventually do, when they cease to get on the roots.

The following are some of the handsomest of the now very numerous, varieties in cultivation:—

B. Acme.—One of the noblest and most striking, the flowers being enormously large. They are salmon red, of a deep tint. The habit of the plant being all that can be desired in regard to sturdy compactness and amplitude of foliage. It is altogether one of the very best yet introduced.

B. Excelsior is of a totally different type to the last, being more free and open in habit, and less ample and massive in foliage. It is, however fully more free in flowering, and the flowers are more brilliantly coloured, being a very fine bright orange scarlet.

B. Chelsonii.—Although very much smaller than most of the other beautiful sorts as regards its flowers, there is a grace and superabundance of flowers about this variety which are charming in the extreme. The flowers are salmon, with a dash of rose shading, and completely clothe the plant.

B. Emperor.—A very noble sort, stately and robust in habit, with large orange scarlet flowers.

B. Vesuvius.—Somewhat like the last in style and colour, and a most beautiful sort.

B. Kallista.—A very distinct species from any of the preceding. The habit is less stiff and stately; and the flowers, which are produced in richest profusion, are deep shining crimson.

B. Stella is similar in colour to the last named, but distinct in habit being almost stemless.

B. Sedenii.—This is magenta rose-coloured variety, of great beauty It is of excellent habit, and very profuse in flowering.—*North British Agriculturist.*

A Poppy the most northern flowering plant hitherto collected.—Papaver nudicaule, the beautiful perennial poppy so widely dispersed in the higher mountain ranges of Europe and Asia, was the most northern flowering plant collected by the last Arctic expedition, having been found beyond the eighty-third parallel of latitude. The same plant ascends to between 17,000 and 18,000 feet in the mountains of Northern India. It may be added that flowering plants ascend to a greater elevation in the mountains of Northern India than in any other mountain chain hitherto explored. Thus many *Cruciferæ*, *Caryophyllaceæ*, some *Ranunculaceæ*, and members of various other families occur up to 18,000 feet, and species of *Draba* have been found, according to Dr. Goppert, as high as 19,810 feet. *Rhododendron niveum* is the last woody plant met with, occurring up to 18,000 feet.

INGA DULCE, cultivated largely in Manilla and South India as a hedge plant and for its fruits, was introduced a few years ago by Dr. Bonavia at the Lucknow Horticultural Gardens, and has been found to succeed there admirably. Hedgerows have been reared to the height of several feet, and the trees have fruited abundantly. In the year of scarcity, the pods were eagerly collected by the poorer classes. A circular letter has lately been issued by the Agricultural Department N.-W. P., advertising that seed can be obtained free of charge, on application to the Superintendent of the Lucknow Gardens. The seed may be sown in the place where a hedgerow or avenue is required. The plant grows very rapidly, and soon forms a high and ornamental hedge or screen, upright and narrow, well calculated for an avenue on a narrow road, or a lofty hedge in front of any ground or public building, which may need such protection. The success of the *Ingadulce* at Lucknow seems to justify its further cultivation and extension in North India, where any plant which provides food of any kind in a season when cereals fail, is a great *desideratum*.

A SHORT notice has appeared in a St. Petersburg journal, of my paper on the absorption of water by the green parts of plants; and it appears to have suggested to Mr. G. Weidenberg a method of striking cuttings. After inferring that the frequent fading of cuttings before they have struck root may be accounted for by a too great transpiration, he proposes making the cuttings longer than usual, and burying some of the leaves as well as the stalk, so that about a third remain above out of the earth. Those leaves in the ground may thus undertake the function of absorbing moisture, and so help to balance the loss of water from the exposed leaves. The ground, he adds, in which cuttings stand should be, if possible, porous, in order that the air may have access, and that the rotting of the leaves may be prevented. This process enables the cutting to make roots before the leaves decay. Weidenberg appears to have found that roses of all sorts, pinks, and other cuttings of plant thus make very good roots, which are usually hard to grow. In my paper I only alluded to cut flowers having leaves attached to the stalk and plunged into water, but the principle is the same as for striking cuttings, and it is so easy to try, that gardeners can readily put it to the test and see if their results will accord with Weidenberg's experience.—GEORGE HENSLOW, in *Gardener's Chronicle.*

SOME observations made by Consul Crawfurd in his Commercial Report on Oporto with regard to Portuguese olives are worth attention. These olives picked and pickled when they are ripe (unlike the olives used in France, which are green, or those larger and coarser ones exported from Spain), are a much used, cheap, and most valuable article of food in Portugal, but are absolutely unknown in England, although, according to Mr. Crawfurd, unquestionably far more delicate in flavour and more digestible than the unripe varieties used by us. The wholesale price of the Portuguese pickled olive is such that if known and appreciated in Great Britain, it could easily undersell the olives of all other countries. A considerable export of Portuguese olives takes place to Brazil; none reach any other country. While the olive of Portugal is conspicuously superior in food-value to the olive of any other country, its product, olive oil, is, however, not made with such care as to enable the producers of it to bring its own intrinsic good qualities, and its far greater cheapness into competition in the English market with carefully prepared oils of Lucca and Provence. The Peninsula is nearer the centre of the geographical habitat of the olive tree than any part of France; its growth in Spain and Portugal is therefore more kindly, its produce more regular, more abundant, of better quality, and the oil derived therefrom of a fuller and richer flavour. Unfortunately its very excellence unfits it for consumption among people like ourselves, whose taste has been educated to like the more vapid prepared oils of France.—*Delhi Gazette.*

WATERING NEWLY PLANTED TREES.

BY A HORTICULTURIST.

(*Journal of Agriculture.*)

AN article lately came under my notice, which I cannot now find, and am not sure whether in the *Journal of Agriculture* or not, that would lead the uninitiated astray.

The writer referred to trees not growing yet, although the parties had watered them several times; he goes on to tell the readers that the roots should have been wet before planting, and says as much as if this had been done, they would have lived and grown, but that the watering since is of no avail.

Now this is horticultural heresy. I have planted trees, &c., for fifty years; from a small number to tens of thousands, in a single season. I have but very seldom wet the roots before planting, and the deaths have been very few.

In the first place, the trees alluded to may have been handled too often, and the roots been exposed to too much air. As to watering trees not doing any good is new to us, but there is the greatest difference in how it is done.

I have seen men water a newly set tree when dry weather followed, that was simply a farce. He might have done it daily for a month, and not even dampened the roots. But when we water, the ground is loosened up as far as the roots extend and then about five gallons poured on slowly and allowed to soak in; then in half a day after mellow the surface, and cover with three inches of mulching. I have not the least doubt but that a dose like this would even now yet start some of the trees first alluded to, unless they carried their death warrant with them to the orchard.

No tree can start growing unless the ground in which the roots are, has sufficient moisture in it to supply the evaporation that goes on in the tree that is out of ground. One good watering is worth more than half a dozen trifling ones. For the last two days our strawberry bed has been in need of water, and the orders given to the boys watering, was to put a can full to every square yard. Even this is not a full dose, but will revive them for a few days. When the ground has become very dry it will require almost an equal bulk of water to the earth itself to saturate it fully to any considerable depth, hence the uselessness of trifling with this thing of watering.

Some writers say let the water stand in the sun half a day, and water in the evening. This watering in the evening is all right, as it has the night to penetrate the earth and is not subject to evaporation, as in the day; but as to cold water hurting plants that are out of doors, is all fudge. If taken from the well fresh, it can be applied to trees or plants at once, and by the time it reaches the roots it is tempered so as to not chill them.

The strawberry plants delight to have cold water dashed by the bucket full on them. When hail falls to the depth of an inch, we have never noticed that plants were injured by the cold water it yielded in melting, which is many degrees colder than fresh spring water.

FORESTRY.

INDIAN FORESTRY.

THERE is no subject at the present time more interesting than this one not only in India, but in all the older countries of the world. Of course in Australia and Tasmania the forests are too luxuriant, and the first duty of a farmer is to clear the land, unless indeed he takes to grazing, and has his horses and cattle roving about amid the trees in the bush. But even in these new countries some systematic preservation of trees is beginning to be found necessary. The Government of the United States is now waking up to the necessity of putting some check upon the reckless destruction of forest, which has been allowed to go on there all over the land wherever a settler plants his foot. In the annual report of the President, Mr. Schurz, the Secretary of the Interior, devotes considerable space to the necessity of taking steps to insure the preservation of the forests. He expresses his opinion, that the disastrous consequences which always follow the destruction of timber in a country will inevitably come upon the people of the United States in a comparatively short time, on account of the rapidity with which the timber growth of the country is being swept away, unless legislation steps in to arrest this indiscriminate destruction. He strongly

renews his recommendation for the passing of a Bill, already introduced in Congress at his suggestion, which exacts that all timber lands, which are chiefly valuable for the timber upon them, shall be *withdrawn from sale or any other alienation under existing laws, and shall continue to be held by the Government with a view to prevent the injudicious destruction of the timber, and to protect the growth of young trees.* In France we find that, with all the praise which has been given to the forest arrangements of that country, and the credit which she has got on account of the skill of her forest officers, the supply of wood is getting scarce, and is altogether insufficient for even "the demands of home consumption." The giving over of the property to the Orleans family involved a surrender of 480,614 hectares of land, and the transference of Alsace and Lorraine to Germany was a loss of other 97,025 hectares of forest land. Since then 10,000 hectares have been bought, but even these do not balance the demand. It is a very difficult business to balance the supply and demand for wood in these days of building and railway construction, especially in a country like India, where wood is, or ought to be, the only fuel, unless coal can be discovered in greater quantities than it has been as yet. Hungary seems to be the only country where the forests not only supply home consumption, but export timber to other countries. The activity of the commerce in wood in Hungary has necessitated the multiplication of the roads, canals, and even railway tracks, in order to facilitate the removal of timber, both for building and domestic purposes. The forests of Hungary comprise twenty-eight per cent. of the whole territorial area of the kingdom, and the (net) sum realized by Government for the sale of the timber is 3,888,977 florins. This shows what can be done in the way of developing forests. A correspondent of the *Indian Agriculturist*, who seems to have much experience in forestry, thinks that there is little use in sending young men to France to learn the business. The best way is to send the forest officer to his work young, and let him learn by experience, the great general rule being to keep out fires and grazing, and the young stuff will be sure to come up. He says,—At our present state of existence, planting, sowing, preserving, and such like cannot pay. If fires are kept out as well as grazing, the forest officer is a good one; if not, he is bad. Indian forestry of our time resolves itself into this; of course, the forest officer has other duties, such as finding the best market for his timber and minor produce, collecting his grazing dues strictly, and preventing stealing, but this is all the work of to-day. For posterity our forests are kept up and should be managed in such a way as to ensure no reduction in value of the property, and an increase in value where possible. The man who makes two blades of grass grow where one grew formerely, is a benefactor. If the forest officer keeps out fires and grazing he will have twenty trees where he found only one. This is the art of forestry for this generation. As to the art being taught in France, Scotland, England or elsewhere, I should say it will be taught better by setting the men to work as youngsters in the forests of India. Of course the Forest Department has its plantations and imported tree gardens, but if the truth must be told, they are only play-grounds of the senior officers. The woods produced in India are quite good enough for all purposes of building, and as sleepers for railways, as to malarias and trees that dispel their charms, they are for the consideration of municipalities. It is advised then that the forest officer should get his experience in India, that he should go to the work young, be of a good sound constitution, with a reasonable amount of the sporting instincts in him, active, and as much of a gentleman as can be had for the money. His having a taste for botany and natural history will be an inducement to his going into nooks and corners, for the same reason liking sport is a good thing, as it takes him out at all hours, combining business with pleasure, helping to check irregularities in his subordinates, and making his solitary life enjoyable. "I know," he says, that many places and many officers have succeeded in growing plantations: I have myself; but there is so much forest to be protected, that they count as next to nothing, except as experiments, and I can say for nearly certain that these experiments would have succeeded as well, if some of our department had not been trained on the Continent. As to finding the best market for produce,—that the trained men had to learn out here; as to protecting from fire and grazing,—that is only to be done by sheer hard work, and requires no training better than is got by finding out for yourself on the fire lines what a difficult task it is. There is no doubt a great deal of common sense in all this, and much saving might be effected by curtailing the expense of the education of forest officers, whom the State, after this special training in France, are bound to provide for, over the heads of others who may in reality be more efficient. It is not in this case, any more than in the case of Cooper's Hill, that the expenses at Home are so great, but a certain number of men come out every year, who must be provided with appointments: this is the difficulty. Of course the number will require to be regulated by the demand; but we hardly see the use of plantations and grounds being kept up as play-grounds for some of the officers of the Forest Department, while others who have not been trained in France do all the real hard work. What has been written by an experienced forest officer ought to meet with attention, care being taken at the same time to avoid taking a one-sided view of so important a matter. One writes in great enthusiasm about the advantage of training our forest officers in France, that they may have a thorough knowledge of how to perform the work of attending to young plantations and of thinning and filling up the gaps in the old; others, like the writer we have been noticing, thinks the principle work in India to be the conserving of forests already in existence. Both the planting of new forests and the conserving of old are necessary; but it seems to us that no one takes sufficient notice of the necessity of clearing away the useless undergrowth which stunts our large trees, and fills up the space where new trees might be planted. We shall return to the subject.—*Deccan Herald.*

THE Government of Assam has profited by the experience of other Indian provinces, and for the last five or six years very commendable efforts have been made to conserve the forests in some of the districts, and to enforce, as regards otherr of them,—*e.g.* Sibsagur, Lakimpur, Sylhet, and the Garo Hills—such rough-and-ready precautions as may prevent their wanton spoliation, pending measures for professional supervision. Unfortunately the staff of Conservators is much smaller, in proportion to the requirements of the province, than is allowed in the case of most local Governments. But even with the inadequate means at their disposal, Mr. Mann and his assistants have added seventy-two square miles to the reserve area during the year 1877-78; so that the total reserved surface measured, fifteen months ago, was 1,982 square miles. Efforts have been made to acclimatize foreign trees; two valuable *Nahor* forests were enclosed, and progress was made with the cultivation of the India-rubber. In the unreserved tracts the work of supervision has been entrusted to the civil officers, and the plan seems to have succeeded well. The general accounts, too, show a total surplus revenue of more than thirty-four thousand rupees, though in the previous year there was a deficit to the extent of a quarter of that sum. The only apparent drawback to this result seems to be the fact that the profit has arisen solely from the non-conserved area. This might appear to imply that more attention was being paid to revenue than to the really scientific work of conservation. However, it is too soon yet to expect profits from the reserved areas. A very noteworthy feature of the year's history has been the successful prevention of forest-fires,—a visitation to which Assam is specially liable during the dry weather. And wonderful to tell, the villagers have in many instances betrayed an intelligent appreciation of the uses of conservancy, and even a readiness to aid the officers in their work. Imagine any Indian villagers capable of rising to the height of such elementary principles of common prudence and common sense!—*C. & M. Gazette.*

IN Japan as well as in India the forest question is forcing itself upon the attention of Government. In recent years the denudation of woods in that country, has bared the hills in the vicinity of the larger towns, with the usual results. The soil has been washed down from the drainage slopes, and droughts have become frequent. We now learn that the Japanese Government have at last adopted the advice which has been given them by the foreign journals, and have instituted a Bureau of Woods and Forests, which, it is to be hoped, will take the necessary measures to prevent the wholesale destruction of timber which has previously been allowed to continue unchecked.

A CORRESPONDENT in a San Francisco paper thus describes a section of a big redwood tree now on exhibition in that city. The section is 14 feet high and 80 feet in circumference; it was cut from a tree 243 feet in height, discovered in Tulare county about 75 miles east of Visalia, and which was estimated to be 4,840 years old. The section was sawed from the tree some 12 feet from its base, and afterwards hollowed out, leaving an outer wall three feet in thickness. The different parts were then hauled to the railroad, 63 horses being used in so doing. It is estimated that the section contains 800 cords of wood. This section, as it now stands, furnishes standing room for 200 persons in the interior. On one side of its inner walls a balcony has been built, a piano and other instruments placed thereon, and from which a musical entertainment is given daily.

THE TALLEST TREE IN THE WORLD.

THE possession of the biggest things in the world, whether animal, vegetable, or mineral, has generally been claimed by America, but in the matter of trees even the giants of the forest to be met with in California must hide their diminished heads before some specimens of *Eucalyptus* recently discovered in Gippsland, Victoria, where the State Surveyor of Forests lately measured a fallen tree on the banks of the Watts river, and found it to be 435 feet from the roots to the top of the trunk. The crest of this tree was broken off, but the trunk at the fracture was nine feet in circumference, and the height of the tree when growing was estimated to have been more than 500 feet. This tree, however, was dead, though there is no doubt that it was far loftier than the tallest *Sequoia gigantea*, the great California tree. Near Fernshaw, in the Dudenoug district, Victoria, there has recently been discovered a specimen of the 'Almond Leaf Gum' (*Eucalyptus amygdalesia*), measuring 380 feet from the ground to the first branch, and 450 feet to topmost wing.

According to the *Scientific American* a sequoia standing in the Calaveras Grove, near Stockton, California, measures 325 feet, and there is no positive evidence that any tree of this genus ever exceeded that height, so that the *Eucalyptus* above referred to would overtop the tallest living *Sequoia* by 125 feet. The girth of the former is given at only 80 feet, which is less than that of many *Sequoias*, but as far as height is concerned it must be considered the tallest living tree in the world.

MINERALOGY.

COAL IN INDIA.

In the last part of the 'Records of the Geographical Survey of India, is a paper by Mr. T. W. H. Hughes on the statistics of coal importation, from which it appears that the annual consumption of fuel for sea-going and war steamers, railways, factories, and other purposes has within the last year or two grown to something between 900,000 and 1,000,000 tons, of which about one-half is foreign coal. Mr. Hughes remarks that, however much this latter fact may be regretted by those interested in the development of Indian coal field there is small chance of a diminution in the ordinary rate of importation until the native product is lightened to some extent of the heavy burden of charges imposed by land carriage and freights. The three principal coal-mining districts—Raneegunje, Karharbari, and the Wardha Valley—are so situated that by the time it reaches a port for shipment the item of railway transport alone has trebled and quadrupled the prime cost of the coal; and this utterly prohibits the sale of the Warora (Wardha Valley) coal within two hundred miles of Bombay. In 1853 the shipments of coal and coke to India were 43,562 tons. A quarter of a century has elapsed, and now they reach 609,735 tons. The rate of increase has not been steady; and wars, and rumours of wars, famines, and improved home freights have always exercised an irregular influence. The main supply of foreign coal has hitherto been derived from the United Kingdom, the contributions furnished by other countries, with the exception of France and Australia being insignificant. The imports from the latter country are, however, sensibly falling off, and Mr. Hughes thinks we have now seen the last attempt to ... the Indian market. Of the five great provinces of ... Bombay is the largest consumer of foreign coal, as it received (in 1877) 368,937 tons out of a total of 523,314 tons, the cotton mills of the City of Bombay and the railways having their terminus there being heavy consumers of foreign coal. In Bengal the railways and nearly all the steam mills burn exclusively the produce of the better seams of the Raneegunge and those of Karharbari field.—*Bombay Paper.*

THE OPENING OF COAL MINES.

The *Shen Pao* publishes a report or some coal mines in the neighbourhood of Ching-men Chow, not far from Ichang. The report is written by a mandarin who was sent to make an inspection, and who was evidently accompanied by a foreign expert

Boring operations, says the report, were commenced late last autumn. The coal-producing country appears to cover an extent of seventy-five square English miles, fifteen long by five broad.

There are ten layers of coal, one above the other. The bed at Wotzu-kow is estimated to be five hundred English acres, that at San-li-kang to be one-fourth its size. It is supposed that 1,200,600 tons of coal can be raised from Wotzu-kow, and 800,000 from San-li-kang, at the rate of 40,000 tons a year. The supply thus would last at least forty years. It is highly probable that further explorations will bring to light fresh beds, as these discoveries are the result of merely the first investigations. It should be mentioned that a few small mines have been opened by the people living in the district, but they have not penetrated to the level of the best coal or largest seams. The bed at Wotzu-kow is one hundred feet below the surface. The coal is just the same as the American anthracite that is brought to China, best anthracite is a most useful kind of coal, being free from sulphur without any impurities.

It gives out great heat, and can be used economically and successfully for smelting iron or other metal It is also suitable for use on board steamers, particularly when ... ed with soft coal. A affording much heat, with but little smoke it commands high price for household purposes. A small proportion only of the coal throughout the world is good enough for smelting, and any foreign country possessing coal of as good quality as that at Wotzu-kow, would be content to carry it hundreds of miles to its smelting furnaces. Specimens of this and of all the native and foreign coal procurable in China have been analysed together, and the new coal have shown itself superior to all for smelting purposes. The Province of Hupei possesses several mines containing iron of excellent quality. If these are worked in connection with the coal mines, large drafts should be obtained, and if the example be followed in other province a source of wealth to the whole country will be opened up.—*Shanghai Courier.*

Probably the hottest mines in the world are those situated on the Comstock lode in Nevada. The highest mine temperature reported to the British Coal Committee was 100° Fahrenheit, but some of the Cornish mines have shown an air temperature rising to 113° Fahrenheit. The hottest water reported in a Welsh mine was at 125° Fahrenheit (J. A. Phillips). In the Comstock mines, according to Professor Church, who has lately described the conditions, the air is never hotter than the rock, as it is in Cornish mines, and the rock in the lower levels (1,000ft. to 2,000ft.) appears to have a pretty uniform temperature of 130° Fahrenheit. The readings were obtained by placing a thermometer in ordinary drill-holes, 10in. to 3ft. in depth, immediately these were finished, and keeping them there ten minutes to half an hour. The mining in the Comstock proceeds with remarkable rapidity the drifts being advanced 3ft., 5ft., and sometimes even 8ft. or 80ft. a day, so that there could not be any sensible diminution of heat at the bottom of drill-hole. The temperature of the air is subject to more fluctuations than that of the rock, for the simple reason that it is artificially supplied to the mine. In freshly opened ground it varied from 108° to 116° Fahrenheit; but higher temperatures are reported at various points (reaching 123° Fahrenheit in one case). The water reaches much higher temperatures, 150° Fahrenheit and upwards. One small stream that had flowed 150ft. over the bottom of a closed drift with little evaporation gave 157° Fahrenheit. Belts of excessively hot ground are often met with in these mines, and also, though fewer in number, belts of unusually cold rock.—*Pioneer.*

The Ootacamund paper says:—"Just within the limit of the contract time, the company working in trust for the estate of Messrs. Nicol, Fleming &. Co., of Bombay, have commenced operations on the gold mines of this district. The sinking of a shaft, intended to be 400 feet in depth, has been begun. This preliminary work is estimated to cost Rs. 10,000. A good deal of active interest is developing itself in connection with these mines. We learn that Mr Wallace, of the Bangalore Victoria Iron Works, has been placed on the staff of Mr. Brough Smythe, where he should prove a useful, if not a valuable, acquisition. Mr. Wallace's iron foundry in Bangalore did some good work but was closed when Lord Lytton suspended all public works in Mysore. There appears to be a prospect of the Government of India establishing a mining department, and the contemplated trip of Mr. Smythe to Simla, of which we hear, is probably in connection with that project."

At the conclusion of the pearl fishery at Arippo early in May, we stated that Captain Donnan had been requested by Mr. Twynam, the Government Agent, Northern Province, to examine certain portions of the north coast of the Jaffna Peninsula, with a view of ascertaining if there were any deposits of pearl oyster on that side of the island, a number of shells, what were evidently pearl oysters, having been washed ashore on the beach at various times during the last north-east monsoons. In compliance with Mr. Twynam's request a thorough examination of the coast line indicated has been made with the assistance of divers and boats, from a spot 20 miles to the south of Mullativu, to about the same distance on the north. No oysters were however found; indeed the nature of the ground along the entire distance—namely, mud and sand—was such as to preclude all probability of meeting with any deposit of oyster. As it is necessary for the bivalve to have a rocky bottom to which to attach itself when first it settles on the ground, no rock whatever was found. An examination of the shells found on the beach shows them to be of the true pearl oyster variety, at the same time they had a very different appearance from the oysters at the Arippo bed, being larger and flatter, of a very pale colour, and their outer surface had a smooth and polished appearance as though they have been carried by currents over the bed of the sea for many miles before being washed ashore. It appears to be thought probable that they may have been washed up from some deep deposit in the Bay of Bengal; at any rate Mr. Twynam's expectation of the discovery of a new source of revenue has not been realised.—*Ceylon Times.*

INDIAN MINERAL INDUSTRIES.

The coal industry in Bengal is conspicuously prominent for the vast strides it has made during the past quarter of a century towards development on a well assured basis, affording steady occupation for upwards of 50,000 souls, with nearly as many more dependent upon them. The mines in Central India have not progressed in the same proportion, though not unsatisfactorily, which can only be attributed to their isolated positions, far from the sea-board. The annual "output" of the Indian collieries, all told, cannot fall below a million tons per annum, and some have estimated it at a much higher figure. The under-estimates that have appeared, are simply due to the fact that they are almost entirely derived from the raisings of steam (larger) coal, irrespective of the smaller rubbles and screenings which, during the past few years, have been utilised for patent fuel in addition to supplying the demand from State railways, foundries and manufactories, lime and brick burning. The capabilities for production of the Bengal collieries are practically unknown,—their

out-turns being regulated, in most instances, by the requisitions they receive for execution: here as elsewhere the deterioration of unexpended stock forming a *serious* loss.

Iron smelting and reduction has, we regret to record, not only been a failure in Bengal, but has met with doubtful success wherever tried, throughout the full length and breadth of India. From Porto Novo in the south, to Kumaon in the north, from Wurdah to Burrakur, the same unsatisfactory reports have been received with little or no variation, except perhaps that in the northern limit mentioned, charcoal had to be used in lieu of coal, thereby incurring the risk of the long train of evils dependent upon forest denudation. The rude native methods, however, practised all over the country, are still in active operation, commensurate with native local requirements; and in some parts of India it is not an unusual sight to meet the iron-smelter carrying his iron for sale to the neighbouring weekly or bi-weekly market gathering, side by side with the cultivator and his grain. This suggests what we have frequently heard expressed, that certain industries in India, machinery and plant, and to her expensive appliances, cannot compete advantageously with manual labour, particularly with the latter, which is both plentiful and cheap. Bengal possesses the exceptional conditions of coal, lime, and ironstone all being found in close proximity in the same locality; and failure can only excite surprise as well as create regret.

Tin mining has been a failure—so far as regards European undertaking—in Burma although carried out on a moderate scale with a fair share of success by the Chinese. This is another fact irreconcilable with the successful operations of the Dutch in Banca and Billiton, and even in the Straits Settlements, where the same deposits have proved most remunerative workings.

Petroleum in Burma is a success, not so much from enterprise, as a plentiful supply. Assam has yet to be tapped, and North-Western India more carefully investigated, in this respect, before we can venture upon an expression of opinion concerning them.

Stream gold washings have been carried on from time immemorial in both India and Burma; but only in the Southern Presidency has *mining* the precious metal been resorted to, and that also during a comparatively recent period. Further prospecting, resulting in valuable discoveries, backed by the opinions of experts, has of late offered a great impetus to extension and development, bidding fair to rival, in course of time, similar undertakings and workings in Australia and California. But it would be altogether premature to anticipate where so much lies in the domain of speculation.

Minor industries, worthy of note, in the Lower Provinces, are those connected with fire clays and talc, apparently exclusively confined to individual firms. We have been long anxious to ascertain whether Indian corrundum would not be an acceptable article in request in the Birmingham and Sheffield markets. In this cursory notice, we have intentionally refrained from mentioning saline substances in general, and salt in particular, and numerous other minerals, with which the country abounds. We have only referred to such of those products as are likely to occupy public attention, demanding capital and enterprise, and in which the experience gained from the present and past is available for guidance in the future.

The extension of mining interests in India, chiefly in coal, at the present accelerating rate, points clearly to the necessity for a "Mines Regulation Act," and we have been informed by those qualified to afford an opinion, that its introduction will ere long be a measure imperatively calling for local legislation—Mining in India is not attended with the same risks as are involved at home from depth, dangerous and explosive gases, &c., but this is counterbalanced by the natural ignorance and carelessness of the *cooly*.

It is satisfactory to learn that the Local Government has called for returns, to be submitted regularly, from each colliery in Bengal, which are intended to supply statistics of labour, out-put, cost of production, &c., and other information necessary to afford data for a comprehensive view of their operations individually not collectively, but *not*, we hope, as is pretty generally believed by the native mine-owners, with the view of exacting royalty or imposing taxes—the effect of which would be to either cripple or destroy an industry which has assumed its present gigantic dimensions, with little or no encouragement from, and is therefore under but few obligations to, the Government.

ANNIE O'B.

The Planters' Gazette.

TEA.

TEA IN THE UPPER PROVINCES.

TEA was introduced into the North-Western Provinces in 1844. In those days it was thought that the climate there, was more like that of those parts of China, where tea was cultivated, than any other part of India, and doubtless, with the light our rulers then had, they were justified in supposing so. As a general rule, tea is grown in China between the latitudes of 30° and 35° north. Although it in fact extends much beyond these limits, still the bulk of the China tea may be said to be grown there; and as the Indian Empire of those times, did not include the Punjab, they could not well go farther north than Dehra Doon, at which place the first garden—Kowlaghur—was opened in 1844. Other gardens followed in Kumaon, and as a move further north could not be managed, the difficulty was thought to be overcome, by opening out at Kumaon, at an elevation of 6,000 feet above sea level, and of 3,700 feet above Dehra Doon. It never occurred to them to imagine, that it was just possible, the Chinese had not fixed on the most suitable portions of their land for this purpose. Given a sufficient and well distributed rainfall; we imagine that tea would pay better in China, if grown from 5 to 10 degrees further south. Prior to that time, the existence of the indigenous variety in Assam was a fact well known, indeed, the plant had been discovered in 1826, but to prevent the possibility of failure, it was decided by the Government to experiment with the China variety only: consequently large supplies of tea seed were brought round from that country, and it may safely be presumed that the Chinese with their proverbial cunning, would not send us the seed from the best varieties of their plants, hence the average run of plant in the north-west is the common China species. *Thea sinensis.*

Transport was very slow in those early times; the Government bullock train delivering goods at Meerut, six months after their despatch from Calcutta. Under these circumstances, a market was sought for close at hand, and it was found.

The natives of Thibet, Turkistan, and Cabul, are great tea-drinkers—at least those of them sufficiently wealthy to be able to afford the luxury,—and sundry Cabulee merchants commenced trading between the North-West of India, and these countries. On the return voyage, their caravans brought wool principally. But these peoples only consume green tea, so *that* became the class of tea made there. This trade has continued to the present time, interrupted now and again, when the restlessness of the border tribes, made the conveyance of goods unsafe. Since 1873 there has been almost no green tea made, for this reason. The Afghan passes have been so unsafe, from the depredations of these wild hordes, that almost no business has been done. Doubtless, it will soon revive, under the fostering care of the sixth and seventh articles of the Gundamack treaty.

The closing of this trade has entailed great losses on the tea industry in the Upper Provinces, as the class of plant there, is not adapted for making the strong rasping tea, so much wanted in the Calcutta market, and planters are at their wits' end, trying experiments to develop the strength; as under present circumstances, they are compelled to make black tea, and *must* sell, in Calcutta or London. The China plant, while making a tea rather wanting in strength, produces a very delicately flavored article, which is much liked by real lovers of tea. It also makes a superior class of green, and hence the demand for it, where this tea is consumed. This trade is one of great profit to the planter, as he can make more green tea than he can of black, he has no expense as to lead and boxes, no anxiety as to his market, and no worry about charcoal, none being required. During the first week of tea-making, the Cabulee merchants—who have established their head-quarters at Umritsur—visit the gardens to make their bargains for the season. They ask the manager to make samples of the several classes of green tea, *viz.* Young Hyson, Hyson, No. 1 Gunpowder, and No. 2 Gunpowder. These are the classes they want to buy. There are however usually other two classes, which may be called the accidents of production, they are, Hyson Skin, and Dust. Hyson Skin corresponding to the Bohea of black tea. These two latter are also purchased, but at half price.

The usual percentages made are 75 per cent. of the best four classes, and 25 per cent. of the others. We will suppose that, after a couple of days' discussion, fourteen annas is fixed upon as the price, the samples are halved, the merchant keeping one set, and the manager the other, they are sealed by both parties, and are kept in bottles to keep out the effects of damp. We have now got fourteen annas as the price, with 75 per cent. of good teas, and 25 per cent. at half price, this represents an average of twelve-and-a-quarter annas per pound, in bulk. It is estimated that the garden will produce that season, say one lakh of pounds; the total price will therefore be about Rs. 76,500. The merchant on signing the agreement to take the entire season's crop, deposits with the manager 10 per cent. of the above amount, as security, which sum lies with the manager till the close of the contract, when it is credited to the last payment.

When a quantity of tea is ready,—such quantity being stipulated in the agreement,—the manager gives the merchant notice that so many thousand pounds are ready,—when he must take delivery of the same within seven days. The merchant comes, bringing his own carts, canvass bags and men. The tea is weighed

out, and packed in cloth bags containing 200 lbs. each; these are encased in strong gunny bags, carefully sewn up, and packed on the carts; before the departure of which, all the tea is paid for on the nail, and thus the business goes on. The merchant sends these bags to Umritsur, where the tea is unpacked and carefully refired; during the refiring, we are sorry to say, they usually add colouring matter, as sulphate of copper and gypsum. The tea is then packed in small water-proof bags, each containing 20 pounds. Two of these are slung like panniers across the back of a sheep or goat, and in this fashion the tea is conveyed across the Himalayan passes. Let us hope that the commercial treaty between British India and Afghanistan will soon be reduced to detail, to admit of this trade opening. At present the quantity made in the Upper Provinces is about two millions of pounds.

MR. F. LINDE has recently published a very useful large scale map of the tea producing tracts of India, compiled from revenue survey maps, from personal surveys and from reports from tea planters. The sheet comprises maps of all the tea districts, including Chittagong and Chota Nagpore; is carefully coloured, (each garden being clearly marked); and is mounted on canvas and rollers. The size is about 6ft. by 3ft.

THE subject of tea and its prospects should be the vital budget of the district, and I therefore cannot conclude without a few comments thereon. The tea trees are apparently recovering the terrible ordeal through which they have passed this year. Owing to the unprecedented drought of the winter months, the planters are all, it may be said, of one opinion on the prospect of bringing up their estimates to any near approach to their prognostications. So far as July has yielded, the return is somewhat hopeful, and with a genial autumn much may be recovered of what has been lost in the previous months. Certainly one point on which the planters may be congratulated is the unusual healthiness of the cooly population. Had it been otherwise, with all the other drawbacks, the consequences must have been most disastrous. The samples of tea that I have seen, appear to be of good quality; the tips being plentiful and the outturn of Pekoe large—and to bear me out in this, I am aware that samples from the Terai have been sent to Williamson Magor & Co. for transmission to the Sydney Exhibition, and much to their credit the samples have been most favorably reported on; and it is to be hoped that the Walers will appreciate the teas as much as we do their horses, and the result will doubtless be, that a trade will spring up in favor of us Darjeelingites with them.—*Darjeeling News.*

WHEN there are no sea-serpents nor gigantic gooseberries to be heard of, the next thing seems the discovery of fresh fields for tea enterprise. At one time it is South America, at another South Africa; just now it is the Azores. As the vines in some of these islands have been a failure, the inhabitants have turned their attention to the cultivation of tea. The plantations are stocked with the best variety of the tea plant, and great expectations are formed as to a possible and extensive crop of tea from St. Michael. Those who have seen the Portuguese in the sugarcane fields of the West Indies are aware of the capacity for work these labourers possess, and also their ability to endure hardships, but we doubt if India and China have much to fear from competition in this direction. A good grape or orange season would soon cause the Portuguese farmer to return to his first love.

"FACED" CHINA TEA.

INDIGNATION has been expressed in the tea trade this week anent an importation of artificially coloured green tea. An attempt was made in public sale on Thursday (says the *Grocer*) to foist upon the home market a quantity of this tea imported from China, but, as will appear, the attempt was not quite successful. The parcel in question consisted of 712 boxes, described as "Ping Suey" Gunpowder, per S. S. *Glaucus*, but in reality more resembled common tea of the old-fashioned Canton make. Some of it had a good appearance, and was highly "faced," but the bulk was very inferior, and all was offered under the saving clause printed in the catalogue of "not inspected." This notification on the part of the importers was sufficient to arouse the attention of the dealers, who then and there protested emphatically that the said tea was unfit for home consumption. It is a singular fact that, although the official inspectors had objected to the admission of the tea into the port of London, the "Board" of Customs, when the matter was brought under their notice for an authoritative and final decision, actually passed it as merchantable. We are, however, glad to say that, notwithstanding the laxity here shown, the leading members of the trade were unanimously of a totally different opinion; and, in taking the question up on public grounds, have acted in an honourable manner. We understand that samples of the said tea are to be forwarded to the Government analyst for his examination and report thereon, which will be awaited with great interest. So far as the consumption of the tea in this country is concerned, however, there need be little fear of its finding a market here, as it has been disposed of chiefly to exporters, and will doubtless be consumed somewhere on the Continent. The prices at which the tea was realised were from 8½d. up to 1s. 3d. per lb. in bond, according as it was more closely in imitation of pure natural tea.—*Home and Colonial Mail.*

A LARGE quantity of "faced" tea has been delivered in London from China. All this should help Indian tea, as none of the faced article goes from here to England. In fact no planter save a native or two in the upper provinces would think of facing tea. We have seen it done, but think it a suicidal process. The green tea is passed through very hot *kurhais* as a finishing process, and when it is to be artificially forced, it is gently sprinkled with a mixture of sulphate of copper and gypsum, the result being a clear silvery gloss which comes off on the hands with a little handling. The tea can have this gloss given to it, almost as completely, by extra hard work in the hot *kurhai*, and it is to save this, that the artificial facing is resorted to. Besides, the gloss from artificial facing is more permanent. In the other case, the slightest damp causes the tea to lose its silvery and glossy appearance. It is however very bad policy, and will do more to hurt the name of China teas, then even a badly made article would.

COFFEE.

REGARDING the coffee crop in the Wynaad, the *Madras Mail* writes :—

Crops generally are reported not promising as heavily as was anticipated from the fine February and March blossoms; but on all well cultivated properties situated away from the ghâts, the results generally are likely to be most satisfactory, and in some cases bumpers will be realized. Leaf disease has as usual reappeared, but the general impression exists that the pest recurs with abated virulence year by year, and that it will in time vanish. Canarese labourers are slow in coming in, and low country coolies have been as yet the principal means of reducing weeds and suckers. The progress of the Mysore Railway is reported to be a source of hindrance to the arrival of the former, and may be a cause of the existing pressure in the labour market; but I feel sure that the main reason why a deficiency of Canarese labour is likely to be experienced, is attributable to the mortality during the famine.

THE following extract from the Proceedings of the Nilgiri Planters' Association, held at Ootacamund on the 9th instant, is very suggestive:—"Read letter from Mr. Henry, late of the Agri-Horticultural Gardens in Madras protesting against the action of the Madras Government in the matter of the disposal of waste lands on the Neilgherries, in consequence of which he had been obliged after three years' residence on the Neilgherries, to leave this district for Bengal, although he had instructions to open a large extent of land here, if the land had been available." Mr. Henry, we believe, sent in three applications for land on the koondahs and in other parts, but never heard about them since. If the policy of Government is to drive settlers off the hills, it is succeeding admirably.

COFFEE DISEASE IN JAVA.

THE following extracts from translations in the *Straits Times*, shew that our neighbours in Java must now look for the spread of the leaf fungus over the whole of the coffee culture, unless they at once adopt the sulphur and lime cure. We are surprised to see no reference made to it, for, on receiving the first definite account of the appearance of *Hemileia* in the Dutch Colony, we sent Mr. Moens full details of Mr. Morris' experiments :—

The Batavia *Handelsblad* of the 3rd May publishes an official report by the Director of State Botanical Garden at Buitenzorg on

the coffee leaf disease in Java, according to which that disease was prevailing in almost every compound in Buitenzorg, and on several estates in the neighbourhood, the Mauritiana and Mocha coffee suffering the most from it. Other cultivated descriptions of coffee were affected by it, though less severely, the Liberian coffee being the only one that hitherto did not exhibit the symptoms known to accompany the disease. Unshaded coffee appeared to suffer more than that under shade. In the report it is further stated :—

"The finding of means to prevent the spread of the disease appears to me to be impossible, principally owing to its present wide diffusion and the microscopic minuteness of the germs. The atmosphere must now contain a very great number of these germs, and also because the disease has probably been existing in another form in a large portion of Java, perhaps for several years. As is known, the disease is caused by a parasitic fungus named *Hemileia vastatrix*. All known parasitic fungi have at least two forms wholly differing from each other, which can both propagate themselves. Of the coffee leaf disease only one form is known. Regarding the other form or forms, nothing is yet known, and hence it is very possible that the disease has been imported hither, or has been existing here for years under the unknown form."—*Herald*.

THE PUBLIC SALES OF COFFEE.

AMONGST the Mincing Lane dealers in coffee a little trouble has arisen which still remains at issue, many suggestions for its settlement having been refused by the disputants on one side or the other. The facts are as follows :—the regulations under which auctions of coffee are held were made about thirty years since, when the importation of coffee was barely one third of the quantity now to be dealt with. Under the present system buyers have to spend more time in valuing and attending at the sales than is necessary, or they can well afford ; whilst sellers are sometimes not able to sell on the day of selection, if they draw a bad number. With the object of altering this unsatisfactory state of things, the selling brokers have proposed to extend the hours of the daily auctions, hence the trouble. A great deal of time is lost in the sales by the disposal of small lots of sweepings damages, triages and overtakers of which the money value is not one-twentieth of the coffee sold. And now the natural remedy for the dispute suggests itself, *viz.* that the damages, sweepings, &c., should be sold separately on one of the four days now available for auction, and a committee of the trade has been called to settle the matter.—*Home and Colonial Mail.*

ACORN COFFEE.

WHEN the Joint Stock Company mania was very acute, and people swallowed the bait offered them by promoters much as a young and hungry fish takes the fly, a gentleman, named Tulloch, was induced to invest £4,000 in a business, the object of which was the making of coffee from acorns. A Joint Stock Company was launched, and, no doubt, all would have gone merrily enough, had not the Inland Revenue interfered. It never, perhaps, occurred to the enterprising gentleman who formed the Pelotas Coffee Company, Limited, that was not legal to sell coffee made from acorns. In any case, they appear to have been so firmly impressed with the advantages of the process that, after receiving an admonition from the Inland Revenue, they again tried to popularise coffee of this description, choosing, upon the second occasion, the title "Surrogate Coffee." Unaware of the previous prohibition on the part of the excise, Mr. Tulloch invested his money in the development of this latter scheme, and was apparently dissatisfied with the result, for he has sued a Mr. Bowerman, who had been connected with the Company, and recovered £3,000 damages. The plaintiff's case was that the defendant knew perfectly well that the manufacture of the coffee had been previously stopped, and that, therefore, there had been misrepresentation. The jury took this view. In the interests of coffee planters, it is just as well that a paternal Government interfered with the operations of the Pelotas Coffee Company.

There may exist a fair field for the development of the acorn coffee trade amongst those who provide pigs and the inferior order of animals, with delicacies, but the ordinary consumer prefers coffee of the real kind, even though it be more expensive.—*Ibid.*

CACAO.

A CACAO planter in Trinidad states that he has trees which yield him 15 and even, in very good years, 18lbs. of clean dry cacao at a gathering. This is a great but not an incredible yield, since Purdie got an average of 11 lbs. at one gathering from some old and neglected, but retrimmed and properly cleaned trees, in the garden, and Lunan, 1814—relying probably on Blume, 1672—says the annual produce in Jamaica's cacao period two centuries ago, was generally estimated at 20 lbs. a tree, and averaged, good and bad seasons together, 1,000 lbs. per acre (8lbs. a [illegible] 18 feet apart—the usual distance there at that period [illegible] poor soil, and under bad management, t[illegible] exceeded 8 lbs. a year. Cacao cultivation [illegible] consequence of the excessive duty then [illegible] the wretchedly small consumption of [illegible] fiscal imposition, and only now [illegible] struggling to regain a place as [illegible] far from being worthy as yet of coming unde[illegible] a stap[illegible] of the old colony.

CINCHONA.

THERE has been some discussion in India lately as to the best and most remunerative method of cultivating cinchona, but it seems still to be a matter for planters to decide as to when the bark is to be considered ripe for harvesting, and whether this should be effected by coppicing and uprooting, or by the more complicated method of mossing. We think that the trees should certainly be allowed to attain the age of nine years before harvesting the bark, for at that period they undoubtedly contain the largest proportion of alkaloids. As regards the process of harvesting, experience points in favour of coppicing and uprooting, though as yet we have no reliable information as to the yield of bark under the mossing system. It appears, however, that under this process the vigour of the older trees on the Nilgiris has been materially reduced. But the great question of importance is whether a cheap febrifuge could not be manufactured locally ; in short whether the quinine could not be extracted for exportation to other countries where its commercial value is high, retaining for Indian consumption the cheaper crystallised alkaloids—cinchonine and cinchonidine, the therapeutic properties of which are almost as high as quinine, and which might be sold at a price that would amply remunerate the planter. If private manufactories were established the difficulty would be solved, and the future of cinchona assured.—*Home and Colonial Mail.*

COPPICING CINCHONA TREES.

MR. BARLOW, Commissioner of Neilgherries, considers the best time for coppicing to be from about the middle of May till the 15th June. After the 15th of June the south-west monsoon may break and diminish the amount of alkaloids in the bark to be stored. The sites for the coppicing experiments have been selected and approved of by Colonel Beddome at the Neddivattum, Wood and Hooker Estates, as well as Dodabetta. Mr. Newman of the Forest Department will directly conduct the wood experiment, and Mr. Schuarre, Overseer, Cinchona Department, instructed by Mr. Rowson, the one at the Hooker Estate ; both these experiments being generally supervised by Major Jago. Mr. Rowson, Assistant Superintendent, will personally carry out operations at Neddivattum. Colonel Beddome proposes to restrict the area experimented on at Neddivattum to 3 acres, because he sees among the trees "very evident signs of constitutional injury." He thus confirms the opinion expressed by the Cinchona Committee and concurred in by his Grace the Governor in Council, who observes that this is a reason for taking a sufficient area to avoid risk or allegation of special circumstances. No reduction in the size of the blocks (*viz.* 5 acres each) to be coppiced will therefore be made. Three methods of coppicing are suggested by the Conservator—

(1) "to nick the bark all round at a level with the ground and saw the tree off about 2 or 3 inches above this."

(2) to repeat the same operations 6 or 8 inches from the ground; (3) to fell no tree until a shoot is artificially produced by removing "a small piece of the bark of the trunk an inch or two above the ground."

The last is not coppicing properly so called, and of the second there are already abundant examples indicating the failure of this system. Proper coppicing is to cut with a clean cut close above the collar, and if the first method is adopted, it must be followed by adzing the stump. The arrangements detailed in the Commissioner's second letter are approved, and his attention is drawn to the necessity of keeping the selling and barking, equally advanced.—*Madras Mail.*

SIKKIM CINCHONA PLANTATIONS.

THE operations in the plantation during the year 1878-79 were greatly retarded by the unusual drought of the cold season, which caused the death of a number of old trees, and prevented the planting out of young trees. The consequence was that the plantation only admitted of being extended by 120¾ acres, against 250 acres in the previous year,—namely, 75 acres in the new or Sittong division, and 45¾ acres in the old plantations at Rishap and Mungpoo.

The continuous increase in the amount of febrifuge manufactured by Dr. Wood is very marked. The outturn of the last five years has been—

	lb	oz.
1874-75	48	10
1875-76	1,940	6
1876-77	3,750	12
1877-78	5,162	0
1878-79	7,007	0
Total ...	17,908	12

but notwithstanding this rapid development of the manufacture the increasing confidence in the efficacy of the febrifuge has raised the demand for it so much that the consumption of the past year greatly exceeded the quantity manufactured. To meet this growing demand the scale of manufacture at Mungpoo has been extended. The cost of the febrifuge manufactured, including the cost of the bark, was Rs.76,459-12-11, or at Rs. 10-14-7 per pound, which is nearly one rupee per pound less than it was in the year 1877-78.

The financial results of the year have been most satisfactory. The excess of income over expenditure therefore amounts to Rs. 53,535-8-10 but from this should be deducted Rs. 11,123-1-3, being the reduction in the value of stock in hand due to the excess of sales over manufacture. This leaves a net profit, of Rs. 42,412-7-7.

The total amount of capital, with interest at 4 per cent. that has been sunk in the cinchona plantations and in the manufactory is approximately ten lakhs of rupees; the receipts for the year under review therefore, after paying all expenses, yielded interest of about 4½ per cent. on the capital outlay, and even if subsequent years show no improvement, as it may be confidently assumed they will do, a sufficient annual income, on the system of accounts followed above, would almost have been realised.

But this system of computing profits fall very far short of doing justice to the real benefit which the Government has derived from the cinchona plantations. The 5,500lbs. of alkaloid taken by the different medical departments replaced an equal amount of quinine that would otherwise have been purchased and supplied on indent to hospitals and dispensaries. At the very moderate rate of Rs. 80 per pound, the cost of this would have come to Rs. 4,40,000, and this amount *plus* the actual sales to the public and Straits Settlements, Rs.41,540, in all Rs.4,81,540, is the true measure of the gain to Government from the cinchona manufacture. Looking at the financial question in this way as may most fairly be done, the plantations by the end of the current year will have cleared off the entire capital that has been invested in them.

CINCHONA IN THE TINNEVELLY GHATS.

COLONEL R.H. BEDDOME, Conservator of Forests, has forwarded to Government 15lbs. of dry bark taken from a portion of a tree of *Cinchona succirubra* grown in the Tinnevelly Ghat forests above Papanasam, and suggests that the same should be sent to England or elsewhere to be tested.

"A few plants were sent from the Neilgherries for trial in this district, and the succirubra plants were put down, at an elevation of about 3,000 feet, in a small clearing in the ghat forests; they have been left entirely to nature, but owing to the moister climate, the growth contrasts very favorably with that of Neddivattum or one of the larger trees to be nearly 50 feet high; it had three large stems at about one foot from the base, the leader having, it was said, been broken by a monkey when young. I requested Mr. Hayne, the Deputy Conservator, to fell one of these stems and dry the bark. Mr. Hayne reported that he felled one of the stems at three feet from the ground, and that the felled portion was 42 feet long and 24 inches in circumference at the base; from 30 feet of the stem, the top of which measures 10½ inches in circumference, he obtained 45lbs. of green bark and 4lbs. from the remaining 12 feet, making in all 49lbs.; and he calculated that he would have obtained 150lbs. if the whole tree had been felled. Mr. Hadfield, who is now in charge, forwards the dry bark; but as it should have dried to not less than 20lbs., it is probable that some was lost or abstracted. It is interesting to note the height of this tree which is very much taller than anything to be seen in the Government plantations on the Neilgherries, and a report on the quality of the bark will be interesting; the latter has probably been dried in the rudest manner, as nothing was known as to how it should be treated."

The Government state that the three cinchona gardens were originally formed in the Tinnevelly district, *viz.*, on the Peria and Chinna Kulirati hills and "on the hills above Papanasam." The former did not succeed, but in 1869 seventeen trees of *C. succirubra* were alive in the Chinna Kulirati garden and thirty-two *C. succirubra* and seventy-five *C. officinalis* in that above Papanasam. At that time all these trees were in a thriving and promising condition, but no subsequent report regarding them appears to have been hitherto received. In the letter recorded above, the Conservator reports on certain *C. succirubra* trees grown in the "forests above Papanasam," but in the memorandum of August 1867, to which he makes reference he wrote regarding the garden at Chinna Kulirati. Both gardens appear to have been formed in August 1866, so that the tree now reported on was between twelve and thirteen years old when one of its stems was felled. Its height 45 to 50 feet is in excess of the tallest tree, 37½ feet, of the same species found by Captain Walker at Neddivattum, where the first planting was in 1862. No comparison of girth is possible as the measurements were taken at different heights. The bark forwarded by the Conservator, which is presumably all stem bark, will be sent home for analysis as suggested. The Government desire to be furnished at an early date with information as to the number, species and condition of the trees still remaining in both the cinchona gardens in the Tinnevelly district, and it should be made clear to which the tree now reported on belongs.—*Madras Mail.*

CINCHONA IN INDIA.

IT is with much satisfaction that I have to report encouraging progress in the great undertaking of which I am treating. A fear exists in some quarters that too much will be attempted in the multiplication of cinchona plantations, but at present there is no reason for such an apprehension, as it is not probable that more than one-tenth part of the bark used by the manufacturers in all parts of the world comes from all these new sources put together. The comparative yield of young plantations and secular forests is well shown in a letter from Mr. Ledger, October 7, 1877.

I see that 22lbs. bark, as the yield of eight-year-old trees, is the average in Ceylon. Of course I could not tell the age of trees I have seen cut down by my contractors, but I well remember a particularly fine tree being cut down in 1851, that yielded more than 500lbs. dry bark—that is, *table* from the trunk, *charqnesillo* from thick branches, and *canuto* from thick branches. The trunk and all the branches were covered with silvery and bright pink moss.

I have often said, and now repeat it, that in my opinion the cultivation of the best forms of cinchona will permanently yield a profit. The present state of the plantations of Java confirms me in this view. The Dutch Government have very wisely availed themselves of the services of an eminent chemist (Mr. Moens,) and by means of his very numerous and careful experiments, have ascertained which form of trees are worth preserving for seed, whilst the others are being by degrees weeded out. In the *Pharmaceutical Journal* for July, 1873, I pointed out the great superiority which these experiments indicated in the sort resulting from seeds collected by Mr. Ledger, and on this account called *Calisaya ledgeriana.* I have now before me more than 120 analysis sent me from Bolivia, which are the result of the above wise and beneficent *oversicht* in the last quarter of 1878. I wish our own Indian Government would follow this example, without troubling you with details (less interesting to your readers), I may say that these experiments make it very evident that the success of the cultivation for the future will be much connected with the propagation of this form of the plant. Next to this comes the *C. officinalis*, and the renewed bark of the *C. succirubra*, which yields about three times as much quinine as the ordinary bark, and is worth more than three times as much to the manufacturer.

The so-called *Calisaya javanica* of the importations of Hasskarl and Schuhkraft are of little value. The "Angelica" is somewhat better.

The Dutch authorities are now quite alive to these points of wise management, and not only give us the advantage of their experience,

and Ceylon, in which they were helped by the great abundance of these seeds last year. In Java, also, the planting of the *Ledgeriana* is going on rather fast; as in the Government and private plantations together there are about a million seedlings ready to be planted in the open air in the next monsoon. The young trees are doing very well and the greater part present all the characteristics of the mother tree. This may surprise those who are not acquainted with the great tendency to sport in all these plants. I have fifteen plants of the *Ledgeriana*, from Java seed, growing under glass. One of these had variegated leaves when young, and is now developing itself into a variety, *frutescens*, which would never rise above the dignity of a small shrub. The others resemble the forms which I have represented as A. B. C., in my *Quinology* of the East Indian plantations, and (with perhaps one exception) will, I hope, give me fine plants of this noble species, which is nothing else than the true *Calisaya!* A (*facile princeps!*) This I conclude from specimens which the late lamented Dr. Weddell gave me after his second journey in Bolivia in 1851, and consequently after the publication of his *Histoire*. These are, from the province of Yungas three, and one from Larecaja; and are called respectively *Calisaya zambita verde*, and *morada* (from the colour of the leaves). The bark, alike in all the samples, presents the characteristics of the *Ledgeriana* of Java. I have before noticed that at first sight the small seed vessels or capsules showed me that the contents of the bag of seed which Mr. Ledger sent over resembled the variety *microcarpa*, which, as given me by Dr. Weddell, I was the first to publish in my *Quinology*. This is the *zamba* of the 'cascarilleros,' and differs little, it is to be presumed, from the *zambita* (a colour somewhat less dark). I may here remark, in passing, that in all varieties of cinchona more is to be learned from the bark, which is absolutely characteristic, than from the leaves, are apt to vary considerably (even on the same tree) as to colour and other particulars.

Dr. Weddell was not so fortunate as to meet, in his first journey, with those splendid forms of *Calisaya* only found now in the less accessible parts of Bolivia. The beauty of the leaves and the brightness of colour, under favourable circumstances, are indeed surprising. I have found leaves of a kindred sort exacly to resemble the colour of the mulberry in the unripe, and again in the ripe stage. Some of my plants will, I think, tend to the *rojo* colour under a brighter sun, but others are of the *verde* tint (green leaves). I attach no botanical importance to these colours, which have no reference to the product of quinine, as I have shewn in the work referred to above. Mr. Ledger writes me (Jan. 2, 1878): "You ask for my candid opinion of the plates [of the *East Indian Quinology*]. They are all beautifully done. The Angelica I like best of all. The large red, or rather purple leaf, is such as the *rojo* or *ledgeriana* in plate IV. should have. Still, all the plates show the cinchona remarkably true. I must say the *Angelica* seems to me as the *Calisaya legitima* of the Bolivian Yungas."

I have noticed "one exception" amongst my *Ledgerianas*, and this brings one back to the question of hybridity, respecting which much has been written, but little so satisfactory to my mind as the remarks of my correspondent. A German, Mr. Otto Kuntze, has recently visited the plantations, and has published his views on this subject. My friend says that he obtained all his information from an overseer, who, in addition to the misfortune of being deaf, still more unfortunately did not know German, at all events he differs widely from Mr. Kuntze's deductions on this subject; as I am also compelled to do, for I do not believe that hybridisation has anything to do with the excellence of the *Ledgeriana*. The impregnation of the stigma of the cinchona flowers is not done by wind, but in Java, by the mediation of a great bombas (drone) which is always to be found on the cinchona flowers flying from flower to flower, and having his proboscis, head, and tarsi full of pollen. My correspondent is not versed enough in the claims which a flower presents to the eyes of an insect before he thinks it beautiful, and so admits that it is possible Mr. Kuntze is in the right when he decides that insects will disdain cinchona flowers because they are not beautiful enough, but my informant thinks them (as I also do) very fair. The bombas should be called in to settle this controversy. Mr. Ledger informs me that bees abound very much in the Yungas in South America, and they are probably the instruments there.

The only peculiarity which *Ledgeriana* has in common with *micrantha* is in the small white flowers which are *nutantes* in both, but far more so in *Ledgeriana*. "If it were a hybrid it ought to have more cinchonine" (indeed the product instead of being almost purequinine ought to be about half-and-half); "and the theory of Kuntze, that quinine increases with more hybridisation, disagrees wholly with the facts."

All the trees of *Ledgeriana* which according to Mr. Kuntze were sterile have flowered last year, and have given an abundance of good ripe seeds.

My correspondent does not deny that hybridisation happens, and that it is the natural consequence of the mediation of the drones when they fly from one species to another. This he conceives to be the reason that their first *Ledgeriana* seedlings in Java sported a great deal more than they do now; as the chance was far greater for impregnation with pollen of another species, when only one or two trees flowered, than now, when a whole garden blossoms, and only pollen from the same species is transferred from one tree to another.

I may add that the above remarks are quite confirmed by the experience of another correspondent of mine in the Wynaad (British India), who has succeeded completely in growing there the true *Ledgeriana* and in obtaining the same bark, with the like extraordinary amount of quinine. This is about 10 per cent., or more than three times that of the renewed *succirubra* bark mentioned above, and it will be remembered that this was itself three times as rich as the ordinary red bark. In addition to this the quinine is of great purity.—*John Eliot Howard, F.R.S., Lord's Meade, Tottenham.—Gardener's Chronicle.*

TOBACCO.

WE are very pleased to be informed that Messrs. Begg, Sutherland & Co's tobaccos from Ghazipore and Poosa are gaining rapidly great credit with smokers in this country. This fact presages success abroad as well as at home. At present only smoking mixtures appear to be issued; but we understand that cheroots will follow in time. The mixtures are pronounced to be equal to any American tobacco that comes to the country, and as it is sold at only half the price, there seems to be little doubt of its extended success. Credit is due to the Agricultural Department of the N.-W. P. for having founded an enterprise which bids fair to produce such valuable results.

DURING the past official year 10,062,010lbs. of manufactured tobacco were exported from Calcutta as against 9,276,622 lbs. exported in 1877-78.

The increase in tobacco is entirely absorbed by shipment to Holland. This may no doubt be attributed to the alleged improvement in, and attention paid to, the cultivation of Indian tobacco. It is well-known that a great part of common cigars are manufactured in Bremen and Hamburg, and are cheap. The improvement in quality of Indian tobacco lately has made it possible to use the Indian leaf, it is said, and consequently there is a demand for it. On the other hand, the exports to Italy have decreased seriously. Those to Spain are *nil*, and the exports to France, though shewing a temporary improvement, are far below the demands in 1874-76, and some allege that the curing of Indian tobacco is so bad that it cannot compete, except at very low prices. In support of this, the total cessation of exports to Spain, over five million lbs. in 1874-75, is quoted as proving that strict measures to prevent smuggling, resulting in a cessation of the trade in five years, shews conclusively that Indian tobacco cannot rival other tobacco on equal terms. The deduction is that the cheapness of the tobacco has tempted the Holland market, it being proverbial that the Dutch cigars are of the lowest quality, while the general verdict of other countries is unfavourable to the class of tobacco as yet produced in India. Again the consumption of Indian tobacco is known to have increased very greatly in India in the shape of cigars. This diminishes the quantity available for export, and further supports those who are sanguine as to the improvement in the Indian leaf for quality.—*Customs Report.*

SERICULTURE.

THE *Japan Mail* deprecates the export of silk worms' eggs from Japan, pointing out that the value of Japanese silk in Europe will increase in exact proportion to the diminution of the despatch of silk worms' egg cards from the East. An export of one million cards will, if the seed be properly hatched, produce in Italy a quantity of silk one-third larger than the total amount of the largest crop ever grown in Japan in one year. The seed of one million Japanese *cartons* is annually hatched in Italy, and therefore the Italian silk crop raised from Japanese eggs is each year one-third larger than the total amount of any crop ever grown in Japan in the course of twelve months. It is evident that if the obnoxious import were to be discontinued, such great speculation upon the future of the European silk crop would ensue as to cause an immediate rise in the prices of Japanese silk.

SILK FROM CHINA.

WHEN the European crop of silk fails a strong demand springs up for Chinese silk. According to Messrs. Eaton & Sons' circular, dated May: "The severe weather prevailing immediately before and after Easter, caused general apprehensions as to the European crop, and most consumers being bare of stock deemed it expedient to buy more freely than has been customary of late; this sufficed to produce a considerable business, and prices improved 9*d*. to 1*s*. 6*d*. per lb. Holders evince a marked disinclination to sell, except in small quantities, even at to-day's rates, the current opinion being, that with a continuation of the present unseasonable weather the crop, already very late, must be seriously imperilled."

It may be interesting therefore, to record the imports into this country of silk from China in past years. Should the fears of a deficiency in Europe be confirmed, there would not only be an enhanced demand upon the Chinese silk markets, but the price would fly up. In 1876 there was a sudden rise under very similar circumstances, and the imports of silk from China in that year were double their value in 1875. One effect of such conditions would be to increase the demand for silver to the East in payment for the augmented absorption of Chinese silk in Europe.

Raw silk imported from China into the United Kingdom.

[000's omitted, thus, 40 equals 40,000.]

	Quantity in lbs.	Value.	Average prices per lb.		
		£.	£.	s.	d.
1867	40	50	1	5	0
1868	90	103	1	2	9
1869	272	319	1	3	6
1870	578	681	1	3	9
1871	1755	1,810	1	0	6
1872	2093	2,145	1	0	6
1873	3133	3,173	1	0	.3
1874	2657	1,996	0	15	0
1875	3463	2,475	0	14	3
1876	4993	4,750	0	19	0
1877	3211	3,172	0	19	9
1878	3320	2,855	0	17	3

THE reports from the silk districts are worse than ever. In Italy the silkworm cultivators have never had so bad a season in prospect,—the mulberry leaf has been developed very sparingly and is deficient in nutritive material, the result being that the silkworm-rearers have been compelled to throw away half their live-stock, while the rest are sickly. The Spanish and French crops are also seriously injured, and the European position is best shown by the following comparison of figures (the estimate being in kilos.), taken from a Lyons journal of authority in this special branch of trade.—

	1878.	1879.	Deficiency.
France ...	560,000	150,000	410,000
Italy ...	2,700,000	1,000,000	1,700,000
Spain ...	55,000	40,000	15,000
Total ...	3,315,000	1,190,000	2,125,000

which is equal to a decrease of 64·1 per cent. The new China silk is said to be fine in quality but somewhat deficient in colour.

IN a recent report on the commerce of Ghilan, Mr. Churchill, the British Consul at Resht, gives some information about the silk industry in Persia. Ghilan is one of the most fertile districts in the Shah's kingdom; almost any plant or tree will grow there. The peasants are prosperous and happy, a day's work, it is said, will give a man enough to live on for a week. Few of them own any land, but they hold it on easy terms. They undertake to clear a piece of jungle. Mulberry trees are planted, the landowner having furnished the seedlings. Some speculator, the *bunniah* of the place, contributes the silk worm's eggs, and in a few years' time the peasant is rearing his worms and producing silk. He keeps a third of the produce himself, a third goes to the landowner, and a third to the man who provided the eggs, and the peasant makes the land pay in other ways—he keeps sheep and cows, burns charcoal, and grows rice. When the silk crop fails, the landowner is the chief sufferer; he has to pay land-tax according to an old assessment, which allows of no remission or suspensions.—*Pioneer.*

MR. F. MAXWELL LYTE, of Jarrow Chemical Works, South Shields, writes:—I see in the *Journal of the Society of Arts* for May 9th, mention is made by Mr. Francis Cobb of the French so-called "secret" for dyeing tusser silk. I believe it to consist simply in the application of binoxide of barium to the bleaching and "decreusage" of this silk. The invention is one of the emanations of the fertile brain of Monsieur Tessié du Motay. I showed the process to a few friends some time since, in the laboratory of King's College, which was kindly lent to me for that purpose. After this treatment, the tusser seems to take all colours with the same facility as the ordinary silks, even the richest blacks. The process is largely employed in both Lyons, Basle, and other places on the Continent.

WORK AT THE FILATURE.

(Communicated.)

IN the days of old "John Company" the silk manufactures of Bengal, under the fostering care of old John became of great importance, and even after the silk monopoly was given up, there was so much capital, energy, and life thrown into it, that it continued to prosper, and if reference be made to the old records available in the "X,Y,Z" and other offices, it will be seen that down to a very recent period, the exports of raw silk from Bengal were very large. Matters then went from bad to worse, until in 1879 the great firm of R. Watson & Co. have been compelled to close their filatures for a portion of the active working season. This firm took up the place that "John Company" once filled with regard to Bengal raw silk, and at times employed over twenty thousand skilled workmen at their numerous filatures, and when one learns that they have been compelled, owing to falls in the market and other causes to stop work for a time, it is only just to conclude that sericulture is doomed in Bengal. True, the natives do an enormous business in raw silk, independent of what the *sahibs* turn out,—and will keep the manufacture alive,—that as they do not care about quality, and work mostly for the Indian market, the industry may be taken as virtually dying out as a source of Government revenue. And it strikes one as very singular that the Government of Bengal who must be aware of the state of the silk business, are doing nothing to assist it, and are even permitting it to die away.

Having this state of affairs in view, I purpose to discuss some of the points that appear to me to be causing a great deal of harm to the silk industry, taken as a business from its origin, the rearing of cocoons to its export in its finished state of skeins of raw silk,—and I will be glad if you will be able to throw further light on what I touch upon, as also point out my errors.

To begin then, I believe that the existence, so to say of the raw silk business of Bengal, depends on three or four great causes:

1*st.* Seasonable weather to rear cocoons in;

2*nd.* A good market in Europe to export the silk to for profitable sale;

3*rd.* Good seed for obtaining healthy worms.

The first of these causes is of course in the hands of God; we are therefore entirely dependant on Providence as to good or bad seasons. The "bunds" when there is seasonable weather are good, and turn out good cocoons, and the silk from them reels well, is otherwise good, and pays in produce. When there is a "bund" coming in, and with it bad weather coming on too, a great number of worms are lost, a great many cocoons turn out bad, the yields are small, and altogether it is a calamity for "silk-*wallahs*."

The second of these causes is dependant on the outturn of the cocoon crop in Italy and China. That is, if the cocoon crops in Italy and China, are extensive and good, the European market is glutted with raw silk from those countries, and of course the Bengal silk cannot compete with it. The fluctuation of exchange has also a great effect on the sales of Bengal silks.

The third cause is one, that cannot affect the silk business as carried on in Bengal, except to a very small extent, because the cocoon-rearing population known as "Bosnias," buy only small quantities of cocoons for seed at a time, and every village does not import seed cocoons from the same place: thus if there is bad seed bought, it can affect only a few villages at a time.

Of course these three principal causes give birth to others, and unless they are all looked into, only a very meagre idea of the evils under which the silk industry labors will be obtained.

Thus taking the second as the great cause on which the activity or otherwise of the silk business depends, it behoves us to find out why the Italian and China silks take precedence of our Bengal silks. I am not in a position to discuss the question in its entirety; but I certainly am in a position to point out why our Bengal raw silks are not so much sought after as they ought to be.

The reason is a very simple one, the Bengal silks, even of the best brands, are not of even quality, that is, although the silks sent out by the best firms from Bengal, are sold generally according to musters, they are not up to the mark they profess to carry, and unless there is a radical and thorough change worked in the routine of sorting the silk, there will always be a doubt as to its quality,—musters notwithstanding.

I do not mean it to be understood from this that the silk manufacturing firms deceive the public, still less that the

gentlemen employed by those firms sort the silk with a view to palm off bad with good; far from it. The firms that are the largest silk manufacturers in Bengal are beyond doubt or cavil the foremost merchant firms of India, and would scorn to send an inferior article into the market with the good brands they own, and whenever any difference in quality in raw silk sold by them is proved by a purchaser, and brought to their notice, they institute the most searching enquiries as to how such an article came to be issued through their agency, and they never lose such opportunities to admonish, rebuke, and punish all hands who have had anything to do with the transaction. Here I must digress a little to point out what most probably the public does not know, *viz.*:—that the raw silk manufacture in Bengal is carried on under the superintendence of a few gentlemen, who have become so accustomed to ancient formulas and routine, that they have kept back the silk industry from progressing as it, like everything else in these stirring times, ought to have done; and so long as these gentlemen are kept on, and their patriarchal routines are adhered to, the quality of Bengal raw silk cannot improve, and the working of raw silk will never be continuously remunerative. Here also I must do the gentlemen whom I allude to, the justice to say that they are not to be surpassed in all the province for their strict attention to business, their probity, and faithful discharge of duty, (with an eye always to the interests of their employers); they also possess all the qualities that are attributes of gentlemen. But they are so wedded to the old, old modes of carrying on the silk business, that they cannot bring themselves to see what the times call for, nay more they cannot bring themselves to believe that the outsiders who attempt to point out to them the changes in the silk market, &c., are any better than ignorant creatures, or that what is being done now under them, in the same way that it was done a century ago, can be otherwise than the correct thing.

With this as an explanation it will be easy to understand how it is that all the exertions of the Calcutta agents to improve the quality of the raw silk must prove abortive. Because when a purchaser who has bought a bale of silk finds that the contents of it does not come up to the high class muster shewn to him, and complains too of it to the Calcutta agents, they, as I have said before, promptly send the complaint to the heads of their manufacturing department with a sharp letter, but there the matter virtually ends. The heads of the manufacturing department test the silk complained of, write back that it is very nearly up to mark, &c., and the matter drops. The purchaser probably loses money on his purchase, and swears against Bengal silk which he never touches again, or he is allowed a set off out of the rate to make up for the inferior quality of the article he has purchased, and is dissatisfied all the same.

I will now proceed to state the routine according to which raw silk is manufactured and sorted in Bengal.

The silk is reeled off in filatures by natives under the immediate supervision of other natives, overlooked by a *sahib*, who has generally two, three, four, or more filatures to look after under him.

The cocoons after having been bought, dried, ovened, &c.—when considered ready for being worked off, are handed out in small (known quantities) each morning to a man called a "kattanee" or his assistant called a "pakdar." The "kattanee" attends to the ungumming of the fibre from the cocoons and manipulates the same into threads of silk, while the "pukdar" turns the reel that draws off those threads so as to put the thread into skeins, where the reels are turned by the aid of steam, no "pakdars" are employed.

Now on this man, the "kattanee," depends the quality of the silk, so far as evenness, color, and softness are concerned. and if he is a good and attentive hand, and will insist on his assistant knotting the ends of the threads whenever they break in their course to the reel; Why, on him will depend the goodness of the silk altogether. Here I must however lay down one maxim that cannot be set aside, and that cannot be got over, and that is, with bad cocoons no good silk of fine quality can be made, the best of "kattanees" with the best of intentions, notwithstanding.

In the evening, or middle of the day, as may happen to be, the "kattanees" finish work, and the silk each man has turned out is inspected and set aside. The next morning the silk made on the previous day is tested by the native headman and the assistant if he knows his work, is put up into skeins, and packed carefully into large boxes for despatch to head-quarters. When there is a sufficient quantity of silk made, it is filled in cotton bags and forwarded to the head office, where it is sorted, tested, baled, and of course after that, sent down to Calcutta.

From the above it will be very simple to deduce that:—

1stly. All the silk of fine quality made from bad cocoons must be bad; and *2dly*. all the silk turned out by inattentive or inexperienced workmen must also be inferior.

Now these are two items that Messieurs, the silk managers do not admit of as portion of the creed they profess, and in place of it they substitute two others.

1stly. "We never buy bad cocoons, and therefore can make no bad silk from our cocoons."

2dly. "We have no inattentive or inexperienced workmen, and therefore all our silk is good."

These two items may be taken as the foundation on which a mass of errors and faults are permitted to rest, causing incalculable mischief, and so long as the silk managers will not divest themselves of this all important idea of infallibility as regards the quality of the silk they make, they will never be able to place silk of a reliable quality in the hands of the Calcutta agents.

I will now proceed to explain this matter at further length as follows.

Suppose for instance there is a filature that works a hundred basins, it would be only natural to expect that the hundred pairs of hands representing the "kattanees" cannot all turn out the same quality of thread. In fact it would be expecting more exactitude than human nature possesses to expect that those hundred pairs of hands will each day, and every day, turn out the same quality of thread; and that none of the out-put of those hundred pairs of hands will be of inferior quality. Apart from this, even admitting that one hundred pair of human hands under the guidance of one hundred "Bengalee heads" can turn out an iudentical article, who is there that will guarantee the identical quality of the cocoons that they have to obtain the thread from? Probably one or two days during the month they have to work off portions of the same batch of cocoons, and on those days very probably the weather is bad. Anyhow, it is only natural to expect that each filature turns out a quantity of bad silk.

One would imagine that knowing such to be the case, and know it every one must, the safe and only way to get at the good silk would be to separate the inferior silk from it at the very commencement. But this is not done. Starting with the axiom that "we make no bad silk, and all the silk that we make is good silk,"—the gentlemen at the head of affairs persist in accepting all the silk sent into them as good silk, and thereafter they sort away as hard as they can to find out if there is any bad silk in it! Not satisfied with this, the good silk is paid for at a higher figure than the bad, nay more, the assistants receive a bonus only on the good silk passed at head-quarters, (known as commission) thus it is the interest of all hands to help to keep up the illusion that only good silk has been made. And it is painful to add that if one of the young men in immediate charge of a filature has the honesty to mention that he has, owing to unavoidable causes, made some inferior silk, he would be set down as a worthless individual, and so this system of duplicity is permitted to exist, thrive, and govern, what goes on at the various stages of the silk manufactory, and of a necessity most mischievous results follow.

The silk from an out-filature when received at head-quarters is weighed and piled up on the floor of a long room, (in which sometimes there may be half a million of skeins of raw silk lying about, it is a wilderness of silk skeins) to be sorted as to color and an approximation of size of thread. Two, three, or more underpaid (for the responsible task they have to carry out) native sorters, are directed to sort the silk. They squat themselves alongside of the pile of silk, and picking up skein after skein, they look at the threads and throw the skeins so looked at on to different spots, according to the quality they decide it to be of. These sorters are all powerful, when they are thus placed; to sort the silk, because there is no one (I mean a *sahib*) to supervise over them continuously, and if they are only well bribed they make "no bones" at all to give the person who has bribed them credit for having made very good silk. In fact they have the whole floor full of silk to pick and choose from, and they make no scruples in substituting good silk for bad, and *vice versâ*, according to the interest they have to fill in the matter. At times the assistant who looks after the sorting, or the general manager comes in, and directs a second and third sorting, but as those gentlemen believe that their duty ends with such order, and they do not, and cannot, owing to press of other work, to wait there from first to last, to see how it is carried out, the sorters have it their own way, and as I have said before, if only well paid they can always deceive the *sahibs*.

Now and then by chance the sorters are "found tripping" when they are punished—then for a few days things go on straight, but they again relapse to the old state of affairs, and will relapse to it so long as the system of sorting is not checked, and a well paid European who understands the natives and silk is not kept to attend to the sorting alone.

While the silk is being sorted a number of skeins undergo testing; this is done by opening out two or more skeins and running off 2,400 yards from each of them, taking care to note the number of breaks in the same; the silk so run off is then weighed. If the breaks in the 2,400 yards do not amount to more than 2 or 3, and the 2,400 (made up of 6 skeins of 400 yards each) weighed skein by skein, do not weigh more than the limit given, as the "titre" the silk is passed as good, and a receipt is given for it as such; taking care to specify in it the classes it consists of, according to the returns of the sorters. In this matter of testing the silk too, the supervision kept up by the *sahib* who keeps an eye on the sorting is merely a matter of form, the natives chalk up as many ends as they are paid to chalk up, and have the opportunity to chalk up; and the man who enters the weights of the testings, generally works for his bribe. The end of it all is that at the end of the season, thanks to the effects of bribery and corruption, a great quantity of bad silk is sent away as good, and the Bengal silk falls in the market as an article not to be depended on. At the close of the season the heads of the business point with pride to the small quantity of bad silk turned out as a per centage over the year's transactions,

and that with the experience of assistants before them, and the full knowledge that there are plenty of bad workmen, bad cocoons, bad working day's, and a dozen other evil causes that must, when added together, make it impossible for such a large per centage of good silk to be turned out.

I know of a man who actually had the audacity to take credit for having turned out in one " bund " about 100 maunds of silk out of which only a few seers were of inferior quality and none at all bad, and that out of a filature where the "kattanees" were known to be only (for the most part) second class hands. The chiefs must have known that it was an utter impossibility to turn out such an enormous per centage of good silk, and so little that was (in proportion to the good) inferior, and their own experience must have told them that there was a gross imposition practised somewhere in connection with the matter, but nevertheless, they closed their eyes over it and hugging themselves into the happy belief that this wonderful per centage of good silk was *de facto* made, they promoted the imposter who brought it about, and proudly handed his name round to others as an example they were to emulate, whereas if justice were done in the matter, every one who had brought about such an impossible per centage of good silk ought to have been punished most severely. More particularly as it was notorious that this same man always managed to obtain good marks for his silk at his head-quarters, and his silk was most grievously complained against by the purchasers in the European markets.

It will be seen from the foregoing that much of the raw silk of Bengal is sent to market as first class silk which is not at all of that description, and as a result it does not give and must fail to give satisfaction, and Bengal raw silk is abused and turns out unsaleable.

It must be admitted that so long as human beings are as at present, they will never be infallible, and so long as filatures are worked, good, inferior, and bad workmen will work in them. Thus, to expect otherwise is absurd, and to close one's eyes to the existence of such workmen, and to attempt to sort silk with a view of finding out what can be passed as good, out of a mass of good and bad, is simply attempting to search for a needle in a pottle of hay and to chance one's good name to ruin.

It will be said if such are the evils under which the raw silk is dealt with. What is the cure for it?

The cure is very simple; to begin with, strike off and never make use of that item of the old silk manager's creed, " we have only good men, good cocoons and make nothing but good silk"—and in lieu of it substitute just the opposite. Next if a cure is to be wrought, take stock of the "kattanees" or work people—and divide them into three grades "good," "inferior" and "bad." Then make them understand that they will be paid according to the work they do. It is a strange fact and one that an outsider will scarce believe in, yet such is the conservatism of old silk managers, that the salaries of the "kattanees" never change. The rice may sell at a maund for the rupee, or five seers for the rupee, makes no difference. The rates for labor may be rising all round, does not matter. "Kattanees" are paid Rs. 5 per month from time immemorial, they are still so paid in the old concerns. It does not make any difference how able the man is, or how long he has served, Rs. 5 is all he can rise to, or obtain. This of itself is a monstrous piece of injustice, and it works accordingly. The silk managers have to look with all the eyes and ears they have, to obtain a fair quality of silk. The men have no incentive to work, and often they can earn more much nearer to their houses, so they do not care whether the silk is good or bad. They take no interest in what they turn out, and very often too when they have a *sahib* whose every argument and aid is a fine cane and it is used unrelentingly, the men purposely turn out bad silk. Thus, one of the measures likely to improve the state of affairs is to classify the work people, and to the first class hands, instead of paying Rs. 5 per month, pay Rs. 7. This will put some life into the men, and if they are made to understand that a single testing of silk, if found inferior, will result in their being cut a portion of their increase, and further that they will even stand a chance of being reduced to a lower grade if they make bad silk, they will soon conform to the arrangement and work well.

Having known the number of workmen each filature has of each class; nothing would be easier than to estimate the quantity of good silk each filature is likely to turn out. The next thing to be done is to cause the head native to send in a statement daily shewing the class of cocoons reeled off each day. The *sahib* in charge when at the filature, certifying how each batch of cocoon reeled that day "turned." This means in ordinary language, whether the cocoons unreeled with ease or otherwise, because cocoons that are at all defective in quality never unreel with ease, and the fine silk from such cocoons, even when worked up by the best hands, is never of the best quality.

Lastly, the *sahib* at each filature ought to sort all the silk reeled in his charge, and be compelled to send it in to head-quarters with an invoice under his hand and signature certifying " on his honor," that "to the best of his knowledge and belief," the qualities of silk set forth in the said invoice had been correctly entered, and that he had seen the silk sorted himself personally.

Guided by such an invoice, with the per centage of good workmen known, it would be very easy for the officials at head-quarters to set about their sorting with some chance of success, and the Calcutta agents could also find it possible to check the passage of inferior silks through their hands.

I suppose the outcry when this is seen will be "why, we shall not have near the quantity of good silk that we will require to make the filatures pay." Also "what shall we do with the inferior silks, they are unsaleable." This is all absurd, because if the agents will only take the precaution to advertise what they purpose doing, and placing a high figure on their first class silks, they will guarantee it equal to test, which they will be able to do safely. No loss will ever ensue. As to the inferior silks they will all sell. The natives turn out silk far inferior to that turned out by *sahibs* and they can sell it; in fact are never at a loss to sell it, why then will the *sahib's* inferior silk not sell?

At present a hundred work-people would probably be paid Rs. 500 or say Rs. 475, because a few of them obtain less than Rs. 5 per month, well, it would not make much difference if the rate were raised.

Ten men	...	...	@	Rs. 6-8	each	Rs.	65-0
Fifty men	...	...	@	„ 5-8	„	„	275-0
Thirty men	...	...	@	„ 5-0	„	„	150-0
Ten men	...	...	@	„ 3-12	„	„	37-8
						Total Rs.	547-8

This would cause a difference of Rs. 70 per month, which on an out-put of 19 seers of silk would be an enhancement of about an anna and three quarters per seer; and when one sees the advantage that will come from it, the enhancement will be a source of gain.

Before concluding these remarks it is necessary to point out that the assistants draw commission on all the good silk they make; this ought to be put an end to. They ought to receive a per centage on the silk made, calculated on its cheapness, that is, a certain figure ought to be fixed for each filature, and the assistants ought to be paid a per centage out of the money they can save out of that rate. The managers too depend on the quantity of good silk they can send off for their profits, this also ought to be put a stop to. The managers ought not to be permitted to push work for quantity. Each filature ought to be taxed with a certain out-put per season, and so long as they can give a fair per centage of first class silk, taking the class of workmen they have into consideration, not as at present through " sharp sorting," no fault ought to be found with them.

I will now end, and if you think it of sufficient interest to be continued, I will let the public see how the old silk managers, acting under their old modes of procedure, " rush " the rates, and make dear silk, when they can with patience and a little new organisation make cheap silk that would pay, and so save their principals, whom they are now in a fair way of ruining.

ON THE TUSSUR SILK OF INDIA.

[BY THOMAS WARDLE, ESQ., F.C.S., F.G.S.]

THE following, on the Tussur Silk Industry of India, is taken from an exceedingly interesting paper read before the Society of Arts. We have selected from the paper only what referred to Tussor Silk.—*Ed., I. A.*

INTRODUCTION.

This interesting and important subject has received so much learned attention during the last fifty years, from both entomologists and sericulturists, that it is impossible now to treat of it in a lecture without saying much that is not absolutely new.

Whilst, therefore, abstract research may have but a narrow field left, I hope that what I have to say may be useful in stimulating a greater utilisation of these products, which are as beautiful as they are curious, and in calling the attention of manufacturers, printers, dyers, and users, to some most important improvements and developments in each of their several departments, the result of a lengthened study of the exact nature of the fibres, and of new and improved modes of manufacturing and decorating them.

Amongst the many names of persons in various countries interested in the cultivation of wild silk-worms, the utilisation of their products, and in the entomology of the subject, I venture to give the following list, which will be found interesting by many, and will serve to show more forcibly to what a large extent this important subject has been made a matter for study and investigation:—

TUSSER AND MOONGA GROUP.

Antheræa mylitta (Drury); *Antheræa paphia* of authors; the *tusser, tussar,* or *tussah* silkworm.—These well-known and valuable insects of various undetermined species, are widely distributed over India, from east to west and north to south, on the coast, and in the Central Provinces. They feed in a wild state upon the ber, *(Zizyphus jujuba),* the asun, *(Terminalia alata),* the seemul *(Bombax heptaphyllum),* &c.

Antheræa mezankooria (Moore); the *mezankoorie* silkworm of the Assamese.—The worms which produce the mezankoorie silk are stated to feed on the addakoory (? *Tetranthera sp.),* which is abundant in Upper and Lower Assam. The silk is nearly white, its value being fifty per cent. above that of the moonga.

Antheræa nebulosa (Hutton).—This is the *Tusser* of the Sonthal jungle of Colgong. It is also found in Singbhoom, Chota Nagpore.

Antheræa Perrottetii (Guér. Mén.).—Described as being found in the districts of Pondicherry, feeding upon a species of *Zizyphus*, the jambool (*Syzygium jambolanum*), &c. Stated to produce four broods in a year.

Antheræa Andamana (Moore).—An allied species to the tusser. Inhabits the S. Andamans.

Antheræa Frithi (Moore).—Himalayas. A common species, inhabiting the hot sub-tropical valleys below 2,000 feet, known only as a wild species. The cocoon is stated to be similar to that of the tusser in form, but of finer silk.

Antheræa Helferi (Moore).—Sikkim Himalayas. This is a common species found in the hot valleys of Sikkim.

Antheræa Assama (Helfer).—The *Moonga* or *Mooga* of the Assamese. The moonga silkworm feeds upon the trees known in Assam as the champa (*Michelia sp.*), the soom, kontoolva, digluttee (*Tetranthera diglottica*), the pattee shoonda (*Laurus obtusifolia*) and the Sonhoolla (*Tet. macrophylla*). It is extensively cultivated by the natives, and can be reared in houses, but is fed and thrives best in the open air and upon the trees. The silk forms an article of export from Assam, and leaves the country generally in the shape of thread.

Antheræa Roylei (Moore).—The oak-feeding silkworm of the N.-W. Himalayas. A common species, feeding on the hill oak (*Quercus incana*) of the N.-W. Himalayas (Simla, Masuri, Almora). The cocoon is large and very tough, the silk being pronounced as promising, and worth cultivating. They can be reared easily in the house.

History of Silk.

A few words on the silk of commerce and its history may form a fit preface in introducing to your notice those wild silks which it is my object to describe to-night.

The name silk is derived from the name of the people of Eastern Asia, whom the ancient Greeks called Seres, and who, no doubt, were the Chinese and who were then, as now celebrated for silken fabrics or seric stuff.

From seres comes the Latin *sericum*, the French *soie*, the German *seiden*, the Anglo-Saxon *seolc*, the Icelandic *silki*, and the English *silk*.

We are informed by Hawse-nan-tze, in a Chinese work called the "Silk worm Classic," that T-eling-she, the principal queen of Hwang-te, B. C. 2640, was the first to rear silkworms, and the Emperor Hwang-te was induced to invent robes and garments from this circumstance.

The queen and wives of the nobles through successive generations personally attended to the rearing of the silkworms. Alas! that, in these days of expediency, hurry and greed, the faith in machinery should have so disastrously stifled the better faith in manipulation, both in silk handicraft work and the old love for the spinning wheel, to the detriment alike of all classes, from the noble to the low born, who have been robbed of much that in by-gone days contributed to the comfort, occupation, and enjoyment, especially of the gentler sex. Surely here is a worthy object of reform for our national art schools. That this silk was of the mulberry-fed kind, is evident from a further extract from the same work, which says that afterwards, "when You regulated the waters B. C. 2200, mention is made in his work on the tribute of the land adapted for the mulberry tree having been supplied with silkworms, from which time the advantage thereof gradually increased." Horsfield and Moore's Catalogue, p. 377.

It is not known whether silk was utilised in India at so early a period as this, probably not, but that India learned the art from China is generally understood, although at what period is not known.

For more precise information respecting the westward spread of silk culture I would strongly recommend my hearers to read Dr. Birdwood's account in his handbook to the British India Section of the Paris Exhibition. This learned history of silk will be read with much pleasure by all who can see in silken stuffs something more than a mere commercial value. The account of its utilisation and spread from East to West is described with almost the charm of romance. Its development is traced from its earliest days in the East to its introduction at last into our own country in the reign of Henry VI., and again to those sad French times of the persecution of the religious Huguenots by Louis XIV., which drove their silk workers by a happy tide to our shores. How that tide has in our own times returned to France, and carried with it not the workers, but the industry, I leave for statesmen—and they have much to answer for—and manufacturers to think over and retrieve.

Europe may be said to have got hold of the silk industry by a fraud; two monks are said to have brought away the eggs from China concealed in their walking canes. A similar account is well related by Dr. A. Wallace of the way the eggs of the prized Yama-mai silkworm were abstracted from Japan by a young Japanese, who obtained them at the instigation of his European tutor at the risk of his life, for this was an offence there punishable by death. It would be but a small return for the benefits we have obtained to ourselves by those frauds if we could teach those weaker peoples the benefits of the better making, and above all the more friendly interchanging of stuffs and commodities. It is with this hope that I put the wild silk question before the Society of Arts, that, having India, with its extensive wild silk regions, in our possession, we may, by gentle means, teach the natives to improve the culture and preliminary stages of its manufacture, so that it may be brought from them in a state fit to be used by us, for all the purposes of which, in its improved state, it is really capable. and, to use the words of Sir Louis Mallet in the first letter of instruction I received from the India-office, that "a new and very profitable industry may be founded in India."

The natural history of every kind of silk may be briefly stated to be this. From a small egg laid by the moth, of whatever species, appears in due season a small larva, or caterpillar, or worm, as it is usually called. This worm after having lived its day, feeding only on the leaves of certain plants characteristic of its species, spins, or rather secretes, a fine thread of silk around itself, for covering and protection during the time it lies dormant in the next stage of its existence. As soon as it has secreted all the silk, it changes into a pupa or chrysalis, and remains inside its silken cell until the time comes for its appearance as an imago, or perfect insect, having four scaly wings, legs, and antennæ. When its hybernation is ended, it emits a fluid which softens the end of its cocoon cell, and by means of its wings, spines and legs, parts the fibres aside until the opening is large enough for it to creep out. After a short time, its wings dry and expand, and it has entered into its perfect state. It lives only a few days in this phase of its existence. It is in this stage only that the race is perpetuated, the female laying a number of eggs, and dying soon afterwards.

TABLE

Of the diameter, strength, and tension of a single fibre and dimensions of cocoon of the chief mulberry and Indian wild silks.

Name of Worm and Silk.	Country.	Diameter in fractions of an inch. Outside of cocoon.	Diameter in fractions of an inch. Inner part of cocoon.	Strength of single fibre in drams avoirdupois. Outside of cocoon.	Strength of single fibre in drams avoirdupois. Inner part of cocoon.	Tension or limit of stretch before breaking in inches of single fibre one foot long. Outside of cocoon.	Tension or limit of stretch before breaking in inches of single fibre one foot long. Inner part of cocoon.	Dimensions of cocoons in inches.
Bombyx mori, or mulberry silk	China ..	1/2150	1,2150	1¼	1¾	2⅞	2⅞	1⅛ × ½
	Italy .	1/2150	1,2100	1	1⅝	2⅝	2⅞	1¼ × ⅝
	Japan ..	1/1600	1/1650	1	1⅜	2⅜	2⅞	1¼ × ⅝
	Bengal ..	1/2000	1/2200	1¼	1¼	2⅛	2⅝	1¼ × ½
Bombyx textor	India ..	1,2500	1/2500	1¼	1⅓	2¼	2⅛	1½ × 1¼
Antheræa paphia, or tusser silk ..	„ ..	1,770	1/710	1	1	7	8	1½ × ⅞
Attacus ricini, or eria silk ..	„ ..	1/1500	1/1430	1	1½	1⅞	2⅛	1¼ × ⅝
Attacus cynthia, or ailanthus silk ..	„ ..	1,1250	1/1250	1	1½	2¼	2¼	1⅜ × ⅝
Antheræa assama, or muga silk ..	„ ..	1/1430	1/1060	1	1⅜	3⅛	3	1½ × 1
Actias selene	„ ..	1/1000	1/1100	1	1¼	2	2¼	2 × 1¼
Attacus atlas	„ ..	1,1320	1/1000	1	1½	2⅓	2⅛	2½ × ⅞
Antheræa yama-mai	Japan .	1/1000	1/1000	¾	1⅜	2⅛	3	1⅜ × ⅝

The Moonga, Mooga, or Muga Silk.

I have here a silk produced from the worm known as the *Moonga*, or *Mooga*, *Antheræa assama* (Helfer), and *saturnia assama* (Westwood). It is found in Assam, and also sparingly in the Dehra Doon, and is the next in importance to tusser. Mr. Geoghegan's description of this silk occupies three pages of the Blue-book on the silk industry of India, from which I abstract the following particulars:—

"The worm that gives the common fawn-coloured moonga silk, when fed on the most common plants, gives a whitish silk when fed on the leaves of other silk. The plants it feeds on are named and estimated as follows:—

"No. 1. *Champa* (*Michelia*).—The silk produced from the worm feeding on this plant gives the finest and whitest silk, used only by the rajah and great people, and is called champa pattea moonga. The thread is sold at from Rs. 11 to 12 a seer (11*s.* to 12*s.* per lb.)

"No. 2. *Maisankurry* (called also addakurry).—The old trees are cut down and the jungle about burnt, and the worms are fed upon the tender leaves of the off-shoots for one year, when the leaves become too old and hard for the worms. Silk is sold at Rs. 6 to 7 per seer (6*s.* to 7*s.* per lb.)

"No. 3. *Soom*.—This is the common tree of the vicinity; the silk from the worms fed on this gives the finest sort of fawn-coloured moonga. Silk is sold at Rs. 3½ to 4 per seer (3*s.* 6*d.* to 4*s.* per lb.)

"No. 4. *Soonhalloo Tetranthera macrophylla*.—This is also a brown silk of inferior quality. This plant is most common in Dhummpore and about Russa Chokey.

"No. 5. *Digluttee Tetranthera diglotica.*—This is also brown silk of inferior quality, but the worms fed on the leaves of this tree increase much in size.

"No. 6. *Pattees hoonda Laurus obtusifolia.*

"The moonga worm gives broods five times a year, and the cocoon is very large, but thin. I could only obtain silk, the produce of worms feeding on Nos. 3 and 4, and manufactured into cheap cloths for the lower classes.

"In its natural fawn-colour it stands washing much better than ordinary silk, keeping gloss and colour till the last.* "

Mr. Geoghegan, on page 114 of his "Silk Industry of India," says :—

"The cycle of the insect is thus given :—

From emergence from the egg to commencement of cocoon	30 days.
In the cocoon	20 "
As a moth	6 "
In the egg	10 "
Total ...	66 days."

In 1873, Colonel Hopkinson, the Commissioner of Assam, gave more modern figures :—

"It thence appears that the soom forests (on which the worm is chiefly fed) cover an area of about 34,000 acres, of which about 18,000 are assessed, yielding a revenue of nearly Rs. 28,000 (£2,800). By far the greater portion of the assessed area lies in the district of Sibsagar. The production of the silk is said to employ some 48,000 persons, but it is not their sole calling. The outturn of silk is estimated at upwards of 100,000 lbs. But as it is admitted that the greater part of the silk is reserved for home manufacture, this estimate cannot be regarded as absolutely trustworthy. The price of the yarn per seer (2 lbs. varies from Rs. 5, (10s.) to Rs. 9 (18s.) in the several districts. The small portion exported goes to Calcutta and Dacca. From the former place it is said to find its way, to some extent, to Bhaugulpur and Bombay."

"The Silk Committee, of the Agri-Horticultural Society reported favourably on some munga silk sent down by Captain Jenkins in 1839, and expressed their opinion that the article was calculated to become of extensive and valuable use to our home manufactures."†

One acre of land yields 50,000 muga silk cocoons, which yield upwards of twelve seers (24lbs). of silk, price Rs. 5 per seer, or 5s. per lb.

From Mr. Hugon's description of the mode of reeling, it is evident it is of the rudest kind, and points to a remedy in the improved continental reeling appliances.

The following particulars by Mr. Hugon in 1834 are interesting :—The Muga silk industry is confined to Assam and some Teperrah villages. The quantity of land planted with food for the Muga was 5,000 acres, capable of yielding 1,500 maunds (123,000lbs.) of silk. The silk formed one of the principal exports of Assam. The average quantity was 257 maunds (21,070lbs.) valued at Rs. 56,054 (£5,605,) leaving the country principally in the shape of thread. He advocates the use of the moonga silk in coloured fabrics, it being easily dyed.

Having only a very small quantity of coarse reeled Muga silk at my disposal my experiments with it have been limited. I find it bleaches well, is very lustrous, and takes the dye freely, better than tusser. Here are specimens of it in the raw, boiled-off, bleached, and dyed states, and also some waste from cocoons for spinning.

The diameter of the fibres of muga silk taken from the external part of the cocoon averages 1/1430 inch, but the external fibres are very variable. The diameter of the inner and less variable fibres is 1/1080 inch. The outer fibres will break with a weight of 2¼ drams on the average, but the inner will support three drams. The tension of the outer fibres averages one inch to the foot, and of the inner 1¾ inches. All the fibres are like tusser, flat and striated, and united in pairs by their edges.

The following table is given by Mr. Hugon, showing the nature and prices of the various kinds of cloth made from moonga silk —

Name of Cloth.	Size of Yards and inches.	Weights.	Price of Thread.	Cost of Weaving.	Total.	Remarks.
		lbs. oz.	s. d.	s. d.	s. d.	
Goovias ...	4 × 30 in	0 12	3 9	0 4½	4 1½	Dhoties.
Ditto ...	9 × 1.4 in	2 0	10 0	1 0	11 0	
Mekla ...	1¾ × 1	0 8	2 6	0 3	2 9	Petticoats.
Rhia ...	6¾ + ¾	1 0	5 0	0 6	5 6	Scarfs.
Gaursha ...	4⁴⁄₁₂ × 20 in	0 4	1 3	0 1½	1 4½	Worn as turbans, or round the waist.
Joon Borta Cappor	6¾ × 1½	2 0	4 0	0 9	4 9	Made of the floss, and worn in winter.

TUSSER SILK.

I now come to the principal subject of may paper, the tasar silk, called also tusser, tasseh, tussah, tussore. It is the product of the larvæ of the moth *Antheræa paphia*, of Linnæus. It is known by the following synonyms * :—

Phalæna, Atticus paphia (Linnæus).
Bombyx paphia (Fabricius).
Phalæna paphia (Roxburgh).
Saturnia paphia (Helfer).
Phalæna, Attacus mylitta (Drury).
Bombyx mylitta (Fabricius).
Antheræa mylitta (Hübner).
Attacus mylitta (Blanchard).
Saturnia mylitta (Westwood).
Bughy silkworm, moth of the Beerbhoom hills.
Kollsurra silkworm, moth of the Mahrattas.

There is but little doubt that this silk has been utilised for many centuries, both in India and China, but have not been able to find any account of its ancient history.

For the history and other particulars of tusser silk I am glad to acknowledge my indebtedness to the report of Mr. Geoghegan. He attributes the derivation of the word tusser to *tusuru*, the Hindostani for shuttle, and states this caterpillar to be the most widely distributed, as well as the most important, of the wild silk producers of India.

One of the earliest notices of this insect, or of a species very nearly related to it, is given by the venerable Rumphius, who was born at Hanau in 1657, in his "Herbarium Amboinense" (dedicated by him to the East India Company), Vol. III., p. 113, pl. 75, he discovered the larvæ in Amboina feeding on the *Mangium cascolari rubrum* (*Rizophora caseolaris*, Lim.), a plant of the order of *terebintaceæ*. † He says :—

"When I had kept the cocoons for three weeks, a moth came out quite perfect, which was the most beautiful and largest I had ever seen, which biting away (the silk), showed its head, and at the same time drew out with it a little flock of yellow silk ; this the moth performed at night. Its body, like all other moths, is a dirty yellow colour, and in length two joints of a finger ; it has two downy horns on its head, of a golden hue, and four large wings, of which the two largest are about an inch long and of a golden colour, but a purple line runs through them transversely, and every wing has, as it were, in its middle a window-like eye, which is surrounded by a purple circle, and, as it were, of the transparency of glass."

The larvæ, when fully grown, are about four inches in length ; they have twelve joints or articulations, besides their extremities ; their colour is green, resembling the leaves on which they feed ; and they are marked with reddish spots, and a reddish-yellow band running lengthways. They feed on several plants :—

Rhizophora calceolaris (Linn).
Terminalia alata glabra (Assum tree).
Terminalia tomentosa (the saj tree).
Terminalia catappa (country almond tree).
Tectona grandis (teak tree).
Zizyphus jujuba (ber tree).
Shorea robusta (sál tree).
Bombax heptaphyllum (Semul).
Careya sphærica.
Pentaptera tomentosa.
Pentaptera glabra.
Ricinus communis (castor-oil plant).
Cassia lanceolata.

In six weeks from the time they are hatched they begin to spin their cocoons, which they most curiously suspend from the branches of the trees by constructing a thick, hard cord or pedicle of silky matter, which is made to grasp the branches, as seen in these specimens.

Tusser silk is found, as you will see by the map, over nearly the whole of India.

In the Central Provinces, Mr. Geoghegan says, tusser is utilised in Raipore, Bilaspore, Sumbulpore, the Upper Godavery, Chanda, Bhundora, Nagpore, Balaghab, Seonee, Chindwara, Betool, and Nursinghpore. Sumbulpore is said to yield 3,500 seers (7,000 lbs.) of silk ; Raipori, 6,000 (12,000lbs.) ; Bilaspore 900 (1,800lbs.) ; and Chanda, 22,500 (45,000lbs. The silk is woven and used in the provinces in mixed fabrics of cotton, wool, and tusser weft. But, at any rate, in some districts, muktabs, garments worn by Brahmins after bathing, cholees, women's bodices, and doputtas and dorwas, seem to be made of pure tusser silk.

Captain Brooke‡ says :—

"In Seonee a regularly organised and thoroughly understood industry from the rearing of the insects to the weaving of silk into cloth, with all its accompanying machinery of trade guilds, money-lenders, &c. This state of things is, in my opinion, no disadvantage ; for, in place of having to contend with the difficulties which, in India, always surround the introduction of anything new or unknown, the demand is all that is necessary to stimulate production to any extent required. Nor is this a figure of speech, for the natural food of the tussar worm is the leaves of the saj, lendeya, and dhowra trees, all of which are found in every part of this district, and are, I believe, common to the whole of Gondwana. These trees are, besides, propagated with facility, and, as far as the requirement of the silk insect goes, are of rapid growth ; hence, if the silk became more known and better valued, and the profits sufficiently attractive, we might

* Geoghegan's "Silk Industry of India," p. 88.
† Ibid. p. 85.

* Horsfield and Moore's Catalogue of Lepidopterous Insects, p. 385.
† Ibid, p. 386-7.
‡ Geoghegan, "Silk Industry of India," p. 109.

witness a development of the culture similar in kind to that which has of late years taken place in the case of cotton. Supposing, then, a demand to spring up, I am of opinion that the supply would, in a very short time, amply meet it. The nucleus of no inconsiderable trade now exists, and only awaits the stimulus of high prices. The primary question, whether the product is, or may become, of such value as to occasion a large demand, is one, perhaps, that more nearly concerns traders than Indian administrations; still, so convinced am I of the value and beauty of the fabric that can be woven from well-reeled tusser, that I would venture to strongly urge Government action in introducing it to the markets of Europe."

The worms require protection from birds and ants, which are their greatest enemies. The first cocoons are made in August, and are sold, after the moth has escaped, to the silk dealers at 4 to 8 pice (1½d. to 3d.) the hundred. The unpierced cocoons are only sold to rearers as seed, at Rs. 1-8 to 2 (3s. to 4s.) per hundred.

Captain Brooke says, "In Chanda and Bilaspoor, Central Provinces, the rearing of the worms is attended by many ceremonial observances, which begin when the insect leaves the egg, and are not discontinued until the cocoons are gathered and taken to the rearer's house. During the feeding of the worm, the Dheemurs lead lives of the strictest abstinence. None of the sex are allowed within a considerable distance of the trees upon which the worms are feeding, and if by chance a woman or impure man passes near the feeding grounds, the trees and worms are sprinkled in the name of Iogni (an incantation of the god Mahadeo, whom the worms are supposed to represent) with water taken, if procurable, from a running stream, and in which tulsi leaves have been steeped. During the same period the Dheemurs carefully abstain from flesh, fish, or haldi as their food, nor do they cut their hair or shave, and carefully deny themselves all ablution. When the cocoons are formed, they collect into a heap, and a goat, pig, or fowl is sacrificed to Mahadeo in his form Iogni, the blood is sprinkled over the cocoons, and, after a bout of liquor, are taken home. On the third day following, the Dheemurs shave and resume their normal condition."*

The caterpillars moult five times, at intervals of from five to eight days. When first hatched they weigh but one-fifth of a grain, and are about ¼ inch long; but at the end of their larval existence, which is from forty to forty-five days, they have attained a size of seven inches long, one inch in diameter, and weigh about 370 grains. They then begin to spin their cocoons, which are, as you see, of an egg shape, and silvery drab in colour. The silk is all regularly deposited in a compact manner, resembling in thickness and substance the shell of an egg.

The cocoons vary much in size. The largest I have seen are from Sumbulpore, and are two inches long and 1¼ inches in diameter, whilst smaller ones are not more than 1½ inches long and ⅞ inch in diameter. The weight of the large cocoons is, without the pupa and supporting pedicle, 28 grains; the smaller ones 8 grains. I have here an unbroken double thread reeled for me, from one cocoon, by Mr. H. Meyer, of Milan. It weighs 12 grains, and measures 1,332 yards, or a little more than three-quarters of a mile.

Mr. Coussmaker remarks †:—

"As a rule, there are certainly two crops in the year; the moths of the first batch come out in about four or six weeks after the first lot of worms (which come out at the commencement of the rains) have spun, those of the second batch remain quiescent until the rains begin again, that is to say until May. As this entails the chrysalis remaining in the cocoon as long as eight months, exposed to the hottest sun and occasional thunderstorms, the cocoon had need to be made of a hard impenetrable material; so indestructible is it, that Bheels and other tribes, who live in the jungles, use the cocoon as an extinguisher to the bamboo tube in which they keep the "palita" or cotton-rope tinder, used by them for lighting their tobacco, and the slow matches of their matchlocks. The cocoon is also cut into a long spiral band, and used for binding the barrel of the matchlock to the stock, being, as the natives say, unaffected either by water or fire. The cocoon consists of two kinds of silk; what it first spins is reddish, and of this the pedicle and outside network is made. This silk consists of threads of different lengths, but the rest is generally unbroken from beginning to end. . . . After the caterpillar has spun a layer of silk thick enough to conceal itself, it discharges some kind of gum or cement, thick and white, like plaster of Paris, and then, with its muscular action, it causes the gum to thoroughly permeate the whole cocoon and solidify the wall. In this manner it goes on, spinning layer after layer of loops, and cementing them all together until the whole of its silk is exhausted, and the wall of the cocoon becomes so hard, that it requires a sharp penknife to cut through it. The ring at the end of the pedicle, which has been spun round the twig, is a most necessary provision of nature, for it often happens that either the caterpillar has been unable to attach its cocoon to a leaf, or that, during the long time the cocoon remains unburst in the tree, the leaf or leaves to which the cocoon was at first attached become separated from it, and then the cocoon hangs suspended to the twig like a berry."

After eight or nine months in the pupa state, a moist spot is observed at one end of the cocoon. The moth is now about to emerge both from its pupa shell and from the cocoon. It secretes an acid fluid, which softens the cement of the cocoon, and enables it to separate the fibres sufficiently to allow its creeping out, it being, no doubt, assisted in this by its short pointed spines. The head of the moth first appearing with its antennæ, broad in the male, and narrow in the female, thus enabling the observer to note the sex, and to put them in pairs. The male moth generally flies away, the night of his exit from the cocoon after his wings become extended and dried. The female rarely does, but during the first three days of her existence she lays her eggs, which hatch in about twelve days afterwards. The new life of the moth does not extend to more than eleven days. As you will see from the specimen in the case, the moth is a fine and handsome insect, measuring across the wings about six inches in the male, and about five inches in the female. You will notice the similar vitreous and transparent wing spots to those of the Atlas moth. These spots are regarded with superstitious reverence by the natives, who see in them a resemblance to the chakra or discus of the god Vishnu, and are therefore induced to consider the moth a sacred insect.*

(To be continued.)

* Captain Brooke, as quoted in Geoghegan, "Silk Industry of India," p. 110.
† The Tusser Silkworm, p. 9, 1873.

* Geoghegan's "Silk Industry of India," p. 111.

Registered No. 182.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY AND STATISTICS.

VOL. IV.] CALCUTTA : MONDAY, 1ST SEPTEMBER, 1879. [No. 9.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so muc' in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

CORRESPONDENCE.

LIMESTONE.

TO THE EDITOR.

SIR,—I send you herewith a sample of the purest limestone, found it being broken up by coolies as metal for the repair of the roads the large pieces underground and partially exposed to view were to much to be removed by pickaxes alone.

It was found about 12 miles east of Hazareebaugh, and 60 fro Giridi, the nearest railway station. The quantity is great, and ther will be little difficulty in quarrying it. The carting would be the mo expensive part, and it might cost from Rs. 80 to 90 per 100 cubic fe delivered at Howrah terminus.

Would you please let me know its commercial value through th medium of your journal.

AMATEUR MINERALOGIST.

Hazareebaugh, 17th August 1879.

INFORMATION WANTED.

SIR,—Kindly let me know by dropping a few lines in answer, whic firm in Calcutta imports flower and vegetable seeds ; from where I wi be able to get coffee, cinchona and vanilla bean seeds ; where M Buck's book on tobacco culture, &c., is sold ; which is the best book o coffee and other culture, and where it is to be got.

Either you or any of your readers will highly oblige me by givi a detailed description of vanilla bean culture and sweeten.n process, &c.

Kindly let me know where I will be able to get *Sorghum saccharat* (China sugar cane) seeds—from its stock juice is produced for makin sugar, &c. I was told by a friend that a sort of millet (*Joware* is introduced here, from which juice is taken out for making suga whether it is a fact, or not, and if so, kindly let me know from wher I will be able to get the seeds.

R. B.

Gwalior, 12th August 1879.

SALT AS MANURE.

SIR,—Anent the employment of salt as a manure, and Mr. Mitchell suggestion in the last para. of his letter quoted at page 265 of yo paper for the current month, allow me to inform your readers th from the opportunities I have had of studying the subject of la irrigated in the Godavery District near the sea-coast, I can affirm th upon lands but newly reclaimed from the sea, and salt water swam the yield in paddy is very large and compares very favourably wi the yield upon older and well manured land in the upper parts of t Delta. There is, therefore, considerable force in Mr. Mitchell's sugg tion.

R. R. E. BROCKMAN,

Captain, R.E.

Tanjore, 12th August 1879.

THE MAHOGANY TREE.

SIR,—Referring to your note on page 263 of your issue for Augu regarding the second unsuccessful attempt to raise the mahogany fro seed supplied to the Madras Government by the Secretary of State, a your advocacy of attention being paid to other timber trees as valuab

and faster in growth than mahogany, I may mention that when employed in the Trichinopoly district in 1871-72, I put down, wherever I was able, on road sides as well as on river berms, cuttings of *Dalbergia sissoo* taken from trees originally introduced into this district by Major-General Lawford of the Madras Engineers.

On returning to this part of the presidency after an absence of nearly three years, I was surprised to find that these small cuttings I had planted had developed into trees 25, 30, and even 40 feet in height, with diameters at 3 feet above the ground varying from 6 inches to one foot. I have watched their growth now since my return for a further period of three years, and am astonished at the rapidity and vigour of their growth. Is the mahogany propagable from cuttings, and may not the seeds sent out by the Secretary of State have been taken from trees propagated in this manner? It is, I believe, ascertained that the seeds of trees grown from cuttings have no germinative power.

R. R. E. BROCKMAN,
Captain. R.E.

Tanjore, 12th August 1879.

ON REELING SILK.

SIR,—In an early number of your paper this year, I observed a number of questions relative to Sericulture, especially with reference to the "Tusser Silk Production," among them, an important one, *viz.*, "The method of reeling from the cocoon, and what to use to soften the cocoon to enable the reeler to take off one thread instead of two or three together," as I find the native reelers do. I should be much obliged if you could refer me to any paper of yours which answers this question, or to any authority who I could apply to on this important subject, as I am much interested in this industry, and much oblige,

PERCIVAL BURY.

Ranchee, Chota Nagpore,
Misra, 14th August 1879.

HONEY.

SIR,—With reference to the article headed "Sweets by the Ship-load" in the *Agriculturist* of the 1st July 1879, page 231, I would be very much obliged if you could let me know where I could get a work treating of honey in all its details, *i.e.*, from the training of the bee-hive to the separation of the wax from the honey.

I have enquired from several sources, where such a work could be had, but to no purpose. My object in these enquiries is the carrying out of a project I have conceived of making the subject a source of study for myself, and perhaps a source of profit to a friend of mine who owns a small estate in these parts, which doubtless is most suitable for my purpose.

A. H.

Naini Tal, 18th July 1879.

HEDGES.

SIR,—Will you kindly inform me which is best plant for hedges, I mean for flower gardens.

Hoping you will excuse the trouble.

KALIANRIN DESAI.

Broach, 7th August 1879.

THE GUANGO TREE.

(*To the Editor of the 'Pioneer.'*)

SIR,—The "guango" tree, to which you alluded in your issue of the 30th ultimo, must surely be the same as was introduced last year under the name of the "rain-tree" (*Pithecolobium saman*). Nor was this its first introduction into this country, as there are fine specimens in the Botanical Gardens, Calcutta, upwards of sixteen years of age. This tree ought most certainly to be extensively planted in India, wherever the climate is likely to be suitable for it, in order to secure the double benefit of good shade and excellent fodder. The result of trials at Saharunpore are not in favour of its being planted so far north as this: the cold is too great, and the air probably too dry during a considerable portion of the year. I have already received an application for some seed of the "guango" tree, and expect many more in consequence of your recommendatory remarks. You may perhaps consider it advisable to make known how far it promises to be useful in this country.

J. F. DUTHIE,
Supdt., Govt. Botanical Gardens, N.-W. P.

ARTESIAN WELLS.

(*To the Editor of the 'Australasian.'*)

SIR,—As a contribution to the discussion on Artesian wells which the long and severe drought of the last summer has given rise to in your columns, I am induced to give you the following particulars of a well sunk in this neighbourhood some four or five years since, which appears to me to partake somewhat of the Artesian principle, and may therefore afford some data to those whose necessities for insuring a supply of pure and wholesome water for their or other purposes compel them to have recourse to well-sinking. The well in question is on the Koorongah Estate, about five miles from Belfast, the property of Messrs. Knight and Lydiard, on the splendid alluvial tract drained into the River Moyne, and known in the earlier days as the Tower-hill Marsh. It was intended to furnish a supply for the use of the stock on the estate, and was obtained under the following circumstances:—A shaft was sunk about 40ft. in depth, without succeeding in finding water, and its abandonment was contemplated. As a last resource, it was suggested that a further trial by means of the earth augur should be made, which accordingly was done to a depth of about 12ft. The withdrawal of the augur was immediately followed by a stream of water so strong, that the workmen employed were glad to make their way to the surface as speedily as possible, leaving their working tools behind them. On the following morning it was found that the water had risen to within 6ft. of the surface, and up to the present time has retained that level undiminished, though affording throughout the year an abundant supply to a large number of stock on the estate. I may also state that the site of the well is near the base of a considerable plateau, having an elevation of at least 150ft.—Yours, &c.

M.

TEOSINTE.

SIR,—Can you inform me through your paper where the seed of the new fodder-grass called Teosinte (and mentioned in your number for August 1st), can be procured. I am anxious to try it.

W. S. HOWLAND.

Mandapasalar, South India,
16th August 1879.

KOTEGHUR NOTES.

SIR,—The weather during the past month has been satisfactory. We have had plenty of rain, but it has come in regular falls, well spread over the month, with sunny days in between. There have been no sudden downpours washing away roads and terrace-walls as in former years, and there have been a sufficient number of dry intervals to allow the rain-water to drain off, and so prevent the roots of plants becoming water-clogged. During the latter third of the month, heavy mists hung about, especially during the mornings. A little more sun would have been beneficial; but we must not grumble, as the weather during the month has been as near perfection as it could have been.

The following is a comparative table of the past 5 seasons:—

	1875.	1876.	1877.	1878.	1879.
Rainy days	25 Very wet.	18 Hot and close at the beginning.	10 Exceptionally dry month. Rainy season crops suffered from drought. Some of the corn not reaped till end of month.	16 Growing showers at the beginning of the month. Hot and close towards the end.	22 Fine growing steady rain, neither too heavy nor too light. Temperature pleasant.

Zephyrs playing lightly about; slight thunder and lighting; the evenings tolerably clear.

The thermometer (Fahr.) hung in an open verandah, W. aspect, is about 67° in the morning, 70° in the evening; lowest 64°, highest 76°.

The pomegranate (vern. *anar*) is out with its scarlet blossom. Lilies of the valley are in great profusion, they have but a slight scent though. The pretty blue forget-me-nots are also out in great quantities, as well as a pink ground-orchid. Ferns in plenty. Wild

geranium in blossom. The purple berries of the berberry (vern. *kesmahal*) are ripe, and being picked and eaten by the village children: the fruit (red berry description) is used to flavour spirits; the root (vern. *rasant*) is used as a dye and as a stomachic. The scarlet potentillas make the mountain sides look quite brilliant. Desmodiums (vern. *katti*) out; bark makes paper and a strong rope. The Virginia creeper is now in green luxuriance, two months hence it will begin to assume its splendid scarlet hues of autumn. Wild-cat's tail out; besides others too numerous to mention. The scarlet fruit so much resembling a strawberry of the white-petalled potentilla is now out.

The birds are tending their young and "bringing them up" for some sportsman to "bring them down." A couple of months or so hence, pheasants promise to be plentiful; frogs are about in great numbers, and on rainy days sing loud songs of gladness; grasshoppers in plenty, and treat us to their shrill songs.

Food-grains are at the same prices; the late harvest has not caused any reduction in prices—wheat at 8-10 seers per rupee. During the first part of the month the villagers were busy transplanting their rice down in the valley; during this time nearly every member of a family possessing rice ground, goes down to assist in the operation, which occupies many days. The family remain down until the fields are finished: the work is unhealthy, and many of the inhabitants lay in a stock of fever which lasts them for many weeks after their return to their upland homes: the work has to be done in fields flooded with water to a depth of six to nine inches, and so what with the wet underneath and a hot sun overhead, with miasma arising from the decaying weeds which are spread over the fields as manure, it cannot be wondered at that the cultivators should suffer from fever; and yet with this great drawback, every zemindar tries to obtain a little patch of rice-ground. In the uplands, the villagers have been also busy weeding their Indian corn (came into flower about the third week), amaranth, millets, hill-potatoes, upland rice, and other summer crops, all of which give promise of a large yield. A portion of the villagers are away at the upper pasturages with their flocks: they went up last month and will return in the beginning of September.

Grapes are beginning to ripen, figs are ripe. Down in the valley, pears, mangoes (small, as they are near the vertical limit of their growth) and quinces are ripe.

In the kitchen garden, Jerusalem artichokes are getting on; scarlet runners in blossom. Artichokes and tomatoes ready. The vegetables, already mentioned in previous months, are most of them still yielding in more or less abundance. Beans luxurians transplanted. That big pumpkin I wrote about last month is still growing and increasing in size. Indigo from the plains sown as an experiment. The flowers are beautiful, convolvulus being in perfection.

G. P. P.

Koteghur, 31st July 1879.

The Indian Agriculturist.

CALCUTTA, SEPTEMBER 1st, 1879.

IMPROVED CULTIVATION.

II.

LAST month we promised to look into the important subject of where the funds for the suggested improvements were to be found. In these days of economising, it is difficult to find money for any purpose, even the most useful, while it seems impossible to do so for objects of doubtful or disputed utility. As this matter surely comes under the head of useful purposes, the money should be available, even if with difficulty. Economy is a relative term; it is often considered true economy to save at whatever cost, whereas it must be admitted that to save a shilling now, is not true economy if it will result in the loss of a pound a few years hence; inversely it is equally true that a sum of money spent now is not extravagance if it will result in manifold profit in future years. We propose then that the State should find the funds for the improvements. Whatever money is required could be obtained in Europe at four per cent., and the sum required would not be much viewed in connection with the amount of benefit it would confer on the rayat. We would suggest the establishment of agricultural banks all over the country, as a first step. It is no objection or answer to this, that if it would pay, private enterprise would have stepped in long ago. This is not so, for the success of this scheme would altogether depend on the principle of advances being repayable in grain. No private banks could attend to this system, and to compel the rayat to repay in cash would simply be to drive him again into the arms of the bunia. This is one reason why the bunia has naturally fallen into this class of business; he has money or its equivalent, good credit, and he has no difficulty in meeting the demands of his constituents where he sees his way to good security—that is to say, to the coming crop, which must be free from other burdens. When the crop is ripe, he has his chuprassies in attendance to see that his principal and interest are duly delivered over. The grain he gets in this way exactly fits him, as it is his principal article of business; but it is vastly different with European banks. They could not possibly have any check on the expenditure or return of their advances, and it would be quite out of the question for them to receive payment in grain, which they would ultimately have to hand over to the bunia *at his own terms*. It may be advanced that the same would apply to the Collector who would have the oversight of this scheme; but no, the Government could attend to it at even a less cost then the bunia, for the staff to see to it is already at hand. The whole business could be attended to by the tehsildar, who has his putwarees and village chuprassies already on the spot, and who are, as a rule, not overburdened with work. We would suggest that small sums should be advanced at the commencement of the season, and during the time the crop was growing, such sums to be repaid, with interest at the rate of six per cent. per annum, by grain, the price of which shall be the market value on the day of payment.

In the bunia's case, when advancing the money, he fixes the price in one of two ways; he either fixes an arbitrary rate per maund, which rate he has ever means of knowing will be immensely in his favour, or he compels the rayat to agree to pay him at so many seers per rupee more than the market rate at the time of payment. If the market price of rice be 16 seers per rupee, he makes the rayat pay him say 21. This excess is not to cover interest; oh no, that is added to the debt, at the previously stipulated rate, which may be, and frequently is, between 37½ and 75 per cent. per annum, the former representing six pies per rupee per month, and the latter one anna.

The Government would in this way be collecting grain from every district in India, and to save loss by a resale, should send it direct to the nearest seaport, Calcutta, Madras, Bombay, Kurrachee or Rangoon, whence it would be shipped direct to London, the proceeds going to the Secretary of State. Sometimes a small loss would accrue, but this loss would never amount to what is lost by remitting—that is, by the sale of the Secretary of State's bills, which is now about 17 per cent.

In addition to this, the Government ought to take the trouble of procuring good seed, and supplying the same to the rayat at cost price. From Dr. Forbes Watson's report on Indian wheat, we find that in every part of India there are varieties of wheat growing which compare favorably with wheat from any other part of the world, and it should be the aim of Government to obtain seed of those qualities and distribute it to replace the vast quantities of rubbish that are grown all over the country. Again, Government could at very small cost introduce superior cattle here and there for breeding

purposes, and in various other ways improve the condition of the impoverished rayat, and thus help to restore the finances of the country, and remove once and for all the stigma that is being sought—and not unjustly—to be fixed on India of her state of bankruptcy.

The rayat having nothing to repay to the lender but the principal, plus a fair and reasonable addition on interest, and not being compelled to sell his grain to meet the claim, would very speedily work himself clear of the bunia, and soon become the real backbone of the country.

The only real objection that might be raised by hypercritics would be interference with private enterprise. We admit the plea, but assert that when the legitimate trader or banker has clearly abused his all but absolute monopoly, he must not object to its being invaded by those who will work it honestly and fairly to all concerned. It is of no use to say that the bunia only exacts "his bond"—only takes what he is clearly entitled to take by the agreement he entered into with the rayat, as we know when a man is in dire want of money he is not entirely a free agent, and must agree to almost anything the lender chooses to propose. We will reserve for a future occasion what we have to say on the duty of Government to endeavour to introduce a better system of agriculture by example and precept. This leads us to the use and abuse of model farms, about which we will have something to say in an early issue.

MANURES AND THEIR CLASSIFICATION.

There are three methods adopted to maintain and improve the fertility of soils :—

1st. Fallowing; 2nd. Rotation of Crops; 3rd. Manuring.

The soil contains an inexhaustible supply of mineral food, not of course all available at once, but only so much of it as the natural processes of disintegration, mechanical and chemical, are constantly liberating. It may, we think, be as safely accepted that the air, water, and the soil contain an equally inexhaustible store of organic food.

It has been held that ammonia (nitrogen) exists in nature in such quantities that, with farmyard manure, it is quite unnecessary to supply it (nitrogen) in artificial manures.

The following experiment, conducted by Mr. Lawes, extending over eighteen years, we think may be held as conclusive in the matter :

Two plots of land, side by side, for eighteen years were manured alternately with ammonia salts and phosphate of lime. In 1852, plot No. 1 was treated with ammonia, plot No. 2 received superphosphate. In 1853, No. 1 got superphosphate, and No. 2 ammonia; and so on for eighteen years. Thus, each plot had been nine times manured with ammonia and nine times with mineral phosphates. Over the whole time the average produce of both was exactly the same, 24⅜ bushels; but the average of the eighteen crops grown by mineral manure alone, whether on plots No. 1 or No. 2 was only 17⅞ bushels; whilst the average of the eighteen crops grown on either plot by ammonia salts was 31⅝ bushels, being an increase of nearly 14 bushels per acre more each year. These results, confirmed by Voelcker, and tested by the practice of agriculturists, in a general way, may be safely accepted as conclusive.

Whatever may have been the practice in times gone by, when land was cheap, and held on favourable terms, with comparatively little machinery in use for agricultural purposes, and when competition had not assumed the proportions that render it imperatively necessary for the agriculturist to avail himself of every legitimate means of increasing the weight and quality of crops,—when agriculture had no existence as as science except in the brain and practice of a few men much in advance of their time, like Blaimire, of Cumberland, who sowed those ideas which the clear-headed tenant-farmers of Cumberland and the North have certainly not let die, and who side by side with Joseph Hume in the days long before liberalism became fashionable, protested session after session against extravagance, corruption, and incompetency,—certainly now-a-days, when the struggle for existence and the survival of the fittest are facts brought home to most men's consciousness, every possible means that may fairly be used to meet the exigencies of the present, ought to be carefully studied and brought into practice.

Manures may be classified in several ways, according to the view-point of the classifier. They may be classified in the three following ways, with sufficient exactitude to answer most purposes:—1st, as to their origin; 2nd, as to their composition; 3rd, as to their uses.

First, as to their *Origin*; they may be regarded as either 1st, Natural; or 2nd, Artificial. This division makes a clear distinction between all substances used as manures which are produced without man's intervention, and those which are the product of the ingenuity of man. Under the former, natural manures, such widely different substances as farm manures, guano, nitrate of soda, lime, and natural products such as these are classed together, although in another view, guano, nitrates, lime, &c., though natural products, are nevertheless artificial manures. More correctly speaking, however, the term artificial might be used to indicate those substances manipulated by the art of man to serve his purposes; and they would embrace every manufactured substance introduced as a fertilizer, such as dissolved bones, and mineral and bone superphosphates of all kinds, as well as those compounds prepared by manufacturers to meet the wants of particular crops—tea, indigo, coffee, grass, potatoe, turnips, &c., and sold under various names. Manures might also be classified either as to their origin or composition, as—1st, animal; 2nd, vegetable; or 3rd, mineral: a classification of this kind, however, is of so vague and general a character, as to render it of little practical use.

Second. Manures may be classified as to their composition, as either, 1st, General; or 2nd, Special. A general manure is one which will supply to the soil and consequently to the crops grown on the soil, sufficient plant-food of all kinds, to keep up the continual fertility of the land. Beef, mutton, wool, wheat, indigo, tobacco, tea, coffee, &c., cannot be taken year by year from the soil; cannot be sold off the land, and leave it in the same position it was before this process began. The speed with which crops and products of various kinds are prepared for the market is much in advance of the slow natural agencies which are continually acting on the dormant constituents of the soil, and changing them into soluble plant-food. A general manure prevents, or at least retards, the consumption of the plant-food in the soil, and makes it possible to go on producing crop after crop, with as much speed as the natural laws which govern its production will admit of. If added in sufficient abundance, it may enrich an otherwise barren or profitless soil, and so enable it to bear a crop that will more than pay the cost of production. General manures, then, must always be the most important, and no others would be used were it possible to obtain manures with the exact composition of the crops to be raised; this, however, cannot be accomplished, and so it comes to pass, that there are always accumulating in the soil vast stores of plant-food, put in year by year in general manures and not removed by successive crops, hence the use of some special manure which, while containing only one important food, deficient in the soil, will enable the crop to take up the abundance of the others which the soil has accumulated or the general manure supplied. Farm manure stands at the head of all general manures. It thoroughly restores to a soil the power of reproducing the same crops. If supplied in sufficient quantities it completely arrests exhaustion, and restores fertility. It consists of the straw used for litter, and the solid and fluid excrements of the animals bred and used on the farm. The excrements are the waste products of digestion, absorption, and assimilation; and if the food of stock be rich in mineral matter, the bulk of the mineral constitutents will reappear in the excrements. Only a small fraction of the mineral substances contained in the food of men and animals is retained in their bodies after they have attained their full growth. When their bodies have been built up to their full size, the mineral substances contained in the excrements are almost identical with those contained in the food. If swine are fed on potatoes, their dung contains the mineral constitutents of potatoes. The dung of horses contains the mineral matter of the hay, oats, &c., on which they are fed;

and it is the same with cattle. The manurial value of their dung will vary with their food, and with the stage at which they have arrived in their progress to maturity, the dung of lean and young animals being least valuable, because they retain in their systems the substances necessary to build them up. When the building process is completed, all that is wanted in food is to repair the waste tissues of their bodies. Farm manure is valuable, not only for its mineral constitutents, but also for the large quantities of organic matter, nitrogen chiefly, thrown off by animals in the action of their vital functions. It has been calculated that 20 tons of farm manure contain 2½ cwt. of nitrogen, and if a four-years' rotation is assumed, this quantity is probably amply sufficient to supply the whole course. In addition to this it should not be forgotten that there are vast quantities of ammonia, N.H. 3 and nitric acid absorbed by the soil and carried down into it by rain and dews; with the application of farm manure, then, there may fairly be supposed to be a gradual increase of valuable plant-food to the soil, and all other things being equal, a continual improvement of its productive powers.

2nd.—Special manures are those which contain chiefly one plant-food, though others may be present. They are only fitted to supply plant-food of a special kind, such as potash, nitrogen or phosphorous. It must not, however, be supposed that they do nothing more; in every special manure there are always other ingredients, which, while they add nothing, or very little, to their market value, are of great use to the soil in helping to bring about its disintegration; and which play important parts in the decomposition and formation of compounds in the soil. It should, however, be borne in mind that they are valuable chiefly, if not solely, from a commercial point of view, for their potash, nitrogen or phosphorous, and that they should be supplied to soils where there is good reason to believe that those substances are deficient, or where their application would bring into usefulness other plant-foods in which the land abounds.

Farm-manure may be used year after year in a perfectly mechanical fashion, and as a matter of course; but special manures demand thought and skill in watching results and arriving at conclusions. The agriculturist who observes and experiments with intelligence on the effects of special manures, is in a fair way of making the most out of his land in the shortest time and with the greatest profit. It is in the use of special manures, however, nitrates, kainites and phosphates, especially the two former, that most unfortunate mistakes have been made by well-meaning men attempting to follow the practice, the successful practice, of some one who has made them his study, and so acquainted himself with all the conditions of success in their application. These conditions are so many and varied, and have reference to the character of soils, subsoils and indigenous vegetation, which sometimes vary over comparatively small areas, that the indiscriminate application of special manures has frequently been followed by disappointment and loss, sufficiently heavy to raise up a feeling of antagonism to what is called high farming and scientific farmers,—a feeling which the conservative tendencies alone of such a profession as that of agriculture were sufficient to rouse, without any additional element of distrust being brought into play, in the failure of imperfectly performed practical experiments. No physician either in England or elsewhere, over the age of forty, ever believed in Harvey and his theory of the circulation of the blood. Younger men accepted the great discovery, and their elders lived and died in the old faith. Much the same thing happens with most great truths: they have to fight their way upward to practical recognition. In this respect, special and artificial manures are no exception.

The following are the chief special manures in the market. It should be borne in mind that Special is here used in opposition to General, and that the designation Artificial is much more commonly applied to them.

ARTIFICIAL OR SPECIAL MANURES.

Ammoniacal or Nitrogenous Manures.

Peruvian Guano.	Manure cakes (Rape).
Ohlendorf Guano.	Wool manure (Shoddy).
Ammonia-fixed Guano.	Greaves cakes (Refuse).
Ichaboe Guano.	Dried blood.
Nitrate of Soda.	Refuse of the bodies of fish and other animals.
Sulphate of Ammonia.	

POTASH MANURES.

Kainite or crude potash.	Muriate of potash.
Calcined Kainite.	Sulphate of potash.

PHOSPHATIC MANURES.

Dissolved bones.	Mineral Superphosphate.
Ground bones.	Bone Superphosphate, a mixture of bone and mineral superphosphate.
Ash of bones.	Phosphatic Guano.
Apatite.	

There remains to be shortly noticed the classification of manures as to their uses. With regard to the effect produced on the soil and crop, manures may be classified as—1st, Stimulating; 2nd, Nutritive; and 3rd, Corrective. All ammoniacal manures may be classed as stimulating (see table above); and in its general action on the soil, lime may also fall under this head. Nutritive manures are those whose special function it is to supply a variety of plant-food, so that farm manures, general manures, would be classed under this head. There is, of course, no manure which does not supply plant-food of some kind, in more or less abundance; but the term nutritive could not be applied with correctness to the artificial or special manures enumerated above, whose special functions are, by supplying one kind of plant-food to enable the crop to take up large quantities of others stored in the soil. Stimulating manures, instead of retarding or preventing the exhaustion of the soil, quicken it by enabling the crop to take up greater quantities of plant-food in a shorter period than without their use could be effected.

3rd.—Corrective manures are those whose application to land acts beneficially on some injurious substance, such as an acid, present in undue quantities in the humus; and it may be by liberating the double silicates already referred to in a former article, thus provide abundant food for a higher and more nutritious class of indigenous plants, which ultimately drive out less desirable ones. The judicious and combined application of salt and lime to properly-drained marsh and low-lying pasture lands is something marvellous, and requires to be seen before it can be realised in its entirety.

The uses of lime and salt as corrective manures are of the very highest value; and the application of artificial manures of the costliest kind would probably be utterly useless, a waste of money and labour, until a change had been effected on the indigenous vegetation of the land. In salt the agriculturist possesses a substance by means of which he can regulate, to a great extent, the growth of the stem in all cereals.

Manures manufactured and sold to suit the requirements of special crops are probably increasing in demand. There are, however, so many conditions necessary to success in producing an article of this kind, that there need be no wonder if they sometimes do not come up to the expectations of the purchaser.

Agriculturists themselves are probably the best parties to observe and experiment on the value of manures prepared to meet the requirements of special crops. It is only just to manufacturers to say, that excellence in the preparation of special manures has been arrived at by very careful researches, and by the mingling together of fertilizing matter in those proportions and combinations which experience has proved likely to produce beneficial effects. It is not the interest of the manufacturer to supply worthless stuff. It is his interest to prepare the purest, cheapest, and best special manure that a careful watching of the markets, and a wide experience of the requirements of a special crop, can command. The conditions of success are, however, as we have said, so numerous and varied, that we may hopefully look for a greater development of this class of manure based on a wider and longer experience.

SPECIAL MANURES.

(1).—For Wheat, Barley or Rye.

2½ cwt. Mineral Superphosphate.
2 „ Sulphate of Ammonia.

(2). Potato Manure.

4 cwt. Mineral Superphosphate.
2 „ Potash Salts.
2 „ Sulphate of Ammonia or Nitrate of Soda.

(3).—For Grass Lands deficient in Potash.

2 cwt. Mineral Superphosphate.
1 „ Sulphate of Ammonia.
2 „ Calcined kainite.

(4).—Manure for Tea Coffee and Indigo.

30 % of Soluble alkalies, chloride of potassium and sodium, and sulphate of potash.
20 „ „ Lime and magnesia.
7 „ „ Phosphoric acid, equal to 15 per cent. of phosphate of lime.
The remainder being sulphuric acid, iron carbon dioxide, organic nitrogenous matter and silica.

The composition of these special manures, is varied according as the requirements of the crop and the nature of the soil are believed to stand in need of particular substances. The quantities

given in (1), (2), and (3) are laid on for each acre; No. (4) is applied at the rate of 10 cwt. per acre.

In the classification in common use, the term Artificial is confined to that class of manures which have come into use during the last forty years. Some of these are in reality natural products, such as guano, nitrate of soda, and kainite, and are misnamed when called Artificial; the phosphates of lime and the ammonia sulphates are manufactured products and are correctly named when called Artificial. Limes, chalks and marls, which have been in use for ages, are correctly called natural. Farm-manures are classed alone. Green manures have been in use in various parts of Europe from very early times. A crop is grown on the soil which is not taken off, but ploughed in. In northern Germany farmers plough in spurrey or lupin to obtain a good crop of rye from a light sandy soil. In America, clover and Indian corn are used for this purpose. The plants best suited for green manuring are those which in a given time will produce the greatest amount of valuable available plant-food with least labour and cost. In England, spurrey mustard and turnips are used. Green manuring adds no new mineral matter to the soil, it simply brings to the surface from greater or less depth material already existing and spreads it out to meet the requirements of the succeeding crop. In addition to this the crop used as a green manure, extracts from the air valuable organic substances which are given up to the soil when the decomposition of the ploughed in crop sets in. In green manuring there is an accumulating of mineral food, and a clear gain in organic matters.

Manures have not exhausted their usefulness when they have supplied, directly, plant-food. They exercise important chemical and physical influences on the soil, some of which have been already noticed, and although, as yet, they are but imperfectly understood, the value of their action is becoming day by day more clearly realised. Farm-manure and green manures, which consist largely of decaying vegetation, are, during the process of decomposition, giving off large quantities of carbon-dioxide and other gases which act on the minerals contained in the soil, at a depth, and in positions where the carbon-dioxide of the air does not find a ready entrance. In this way they materially aid the disintegration of the particles of the soil and the liberation of soluble plant-foods. They effect the physical properties of soils. Heavy clays are rendered lighter and easier to work; each straw is an underground drain conveying moisture and air where they would not otherwise easily find their way.

MONSR. MONTCLAR'S METHOD OF AGRICULTURE ON STEEP LANDS.

(Communicated.)

I.

WHEN the European coffee enterprise in Ceylon, and in Southern India, is in general, in a most critical condition, it is necessary to consider carefully, and in a dispassionate manner, what are the causes of such general decline, and what are the possible practical and economical remedies, to prevent the ruin of many coffee enterprizes.

The direct application of sulphur, or sulphur and lime, in powder or in solution, over the leaves of the coffee trees of an estate, has been recommended, as a trial, to the coffee planters by Mr. D. Morris, the Assistant Botanist at Peradinnyia, Ceylon.

The use of sulphur and lime over the leaves has for its object the destruction of the *fungi* on the leaves (*Hemileia vastatrix*). But as observed by Monsr. Montclar, such destruction of the *fungi*, even if successful, will be very expensive, because it will require several successive applications of the process.

As *weeding* operations are required *monthly* on the estates, Monsr. Montclar recommends strongly the *burial of the leaves*, as much more economical, more effectual, and much more scientific than the superficial application of any ingredient over the leaves. Mr. D. Morris does not consider it necessary to enquire about the disease of the coffee leaves, "where it came from;" when, on the contrary, the practical Monsr. Montclar considers it of the *highest* importance to know "where the leaf disease came from." Persons interested in these questions will read with much interest the new pamphlet of Monsr. A. Montclar. "Soil diseases are the principal causes of the coffee tree diseases in Ceylon and in India."

For our part, we fully agree with Monsr. Montclar, when he says: "The European undertakings on steep lands of the hilly "countries cannot be a full success, and particularly a success of long "duration, if the washing away of the soil by the heavy rains of the "monsoons is not prevented *entirely*! Indeed, the rich surface "soil of the land (the humus) is the 'natural protector and fertilizer "of the tree under cultivation,' and under a tropical climate *particularly*, when the land has lost 'its natural cover,' which protects "it against the *heat* of the sun during the day, and against *cold* during "the night, the vitality of the cultivation made on such soil is in "*danger*, and the plant then struggles for its life; and hence those stages "of the *original* disease which have engendered the *several diseases* "of the coffee tree, with which the coffee planters of Ceylon and "Southern India have to contend.

"Amongst the diseases of the coffee tree, the most apparent is, of "course, the sickly leaf, because it strikes our eye, when the deficiency "of the 'soil' and the diseases of the 'roots,' are not so apparent "as the 'leaf disease. Hence the general complaint of 'leaf 'disease' for the mere superficial observer, but for the scientific agri"culturist, who sees deeper and farther, who regards the matter in all "its various aspects, it is the outward evidence of internal and sys"tematic mischief."

Is it possible to have any thing more clear than the opinion expressed by Monsr. Montclar?' He is so much impressed with the ultimate loss which will result in consequence of "the wash of the soil," that he goes on as follows:—

"But no cure is possible, if *before anything else*, the coffee planters "do not succeed in making some mechanical agricultural works, so as "to protect their soil against wash."

Hence, terracing with stones; but a great many estates have no stones at their disposal, and it is precisely on that particular point that Monsr. Montclar's method of protection is valuable, in using the poor *subsoil* of the land instead of *stones*, because planters are fully satisfied that the terracing with the sub-soil is far stronger and much safer than terracing with stones, as proved in Ceylon by Monsr. Montclar.

Here are the opinion of some of the leading planters of Ceylon about Monsr. Montclar's agricultural new works:—

Laymastota Estate, 18th December 1878.

A. MONTCLAR, ESQ.,
Laymastota.

DEAR SIR,—As requested, I have the pleasure of making a few remarks on your system of work.

You commenced operations on this estate about two months ago, and I have found during that time both the squares and banks have withstood the rain admirably. I think the coffee would have suffered before this if too much moisture had been retained in the squares, as I find after the heaviest rain that it is all absorbed by the soil, within an hour,* and I particularly noticed the good colour of the four acres of coffee that were operated on by you.

Your method, as far as I can see, combines three works,—namely, terracing, forking, and draining, at a far better and cheaper rate than is our present system; at the same time a few drains might be advisable for fear of accident. As regards your method, I consider your personal supervision and advice necessary to any one willing to adopt your system, because you have suggested to me many different ways of operating on the land according to circumstances and various slopes of the land. I may add that several planters of experience who have seen your work here, have expressed their good opinion regarding it.

I remain, &c.,
EXHAM SWYNEY.

Dickapitiya Estate, 28th December 1878.

A. MONTCLAR, ESQ.

MY DEAR SIR,—I have the pleasure of replying to your letter of the 27th instant, wherein you request me to pronounce upon the mode of agriculture which you propose to carry out on coffee estates in Ceylon.

From the small practical experiment which you made here, and from my Superintendent's report of one acre which you supervised the planting of on my estate near Balangode, I cannot but gather most favourable impressions, and I am particularly in favour of the forking and loosening the soil, which can only be done upon steep land, when precautions have been adopted to prevent its being carried into the ravines by heavy rain.

The banking and terracing process, no doubt, costs a little at first, but with the new tools which you propose taking out a patent for, this may, to a certain extent, be reduced.

* It is precisely the cheap Agricultural work proposed by Monsr. Montclar to the Government of India, so as to prevent *inundation*, and re-establish moisture on the denuded lands of the Upper hilly countries.

It is too soon yet to be able to say what the return may be, so that I can only give an opinion upon your system of cultivation, as likely to be of great importance to proprietors of coffee estates, who may be willing to try the experiment.

I remain, &c.,
SHELTON AGAR.

Kelburne Estate, 5th December 1878.

A. MONTCLAR, ESQ.

DEAR SIR,—In reply to your letter of the 3rd instant, I beg to make the following remarks on your new method of terracing coffee on sloping ground.* I closely watched your operations here on the acre or so of coffee which I gave you to experiment upon,—coffee varying from very steep to moderately steep.

I am of opinion that if your terracing resists heavy rainfall, and if too much moisture is not retained in the squares, you have originated a method which should be of immense value to the coffee planters of Ceylon. It is too soon to give a final opinion on the strength of the work; but from the way in which your work has already stood in some tremendous downpours, I have every confidence that the work is permanent. As to the retaining too much moisture, I cannot see any probability of it.

Two very strong points in favour of your method seem to me to be the great simplicity of the work, and the moderate cost at which it may be carried out. Given that your work stands heavy rains, and too much moisture is not retained; you put us in a position to apply to every tree in its square, manure which cannot be lost, and in a much more effectual manner than it is now possible to apply it.

Another important point gained by your method is that, in case of the crop falling before it can be picked off the trees, it must remain in the squares, instead of being washed down, as so often happens, to the nearest ravine.

In conclusion, I may remark that I do not think any one can form a just idea of your method who has not seen it practically illustrated. The opinion I have expressed on your work is shared, as you know, by some planters of large experience, who have seen it here and elsewhere.

I am, &c.,
JOHN H. CAMPBELL.

Since operating on Nine Estates in Ceylon, Monsr. Montclar has found the *necessity* of using some combined tools, so as to be successful in making strong and cheap works. He is just now in consultation with a few mechanical engineers of talent for improving these tools, and then to secure the British Patent in London.

Monsr. Montclar's great object is to prevent *entirely* the wash of the soil, and thus to be in a position for "forking and loosening the soil well," so as to obtain the maximum benefit of "the atmospheric electricity in the soil, and hence to the roots."

On that most scientific point, Monsr. Montclar's method is perfectly right, because, when the soil of estates (on steep lands) is kept *unloosened*, and often *hard* like a stone, how is it possible for the roots to have free extension?

How then is it possible for the "atmospheric electricity" to penetrate the soil for its benefit in oxidation, and the great benefit of the roots in their work of *endosmose* (ascension of sap)? Some men, ignorant of modern scientific agriculture, have attempted to turn into ridicule the plan of securing for the plant under cultivation the maximum of the "electric fluid" contained in the atmosphere and in the rain, without knowing the *immense* influence "atmospheric electricity" has on the growth and nutrition of plants, and that particularly under a tropical climate.

Most decidedly no full success, no durable success, is possible on the steep lands of the hilly countries of India and Ceylon, without securing to the plant under cultivation the total amount of the "atmospheric electricity."

Perhaps these ignorant men who oppose this plan will be induced to modify *their opinions* after reading the following:—

"An account of experiments communicated to the academy of "sciences, Paris, contains particulars interesting to students of the "physiology of plants, and to agriculturists. Mr. Grandeau desiring "to ascertain whether atmospheric electricity had any influence on the "growth and nutrition of plants, instituted a series of experiments "on plants of the same kind under different circumstances. One "set (tobacco, maize, and wheat) he placed in a case open to the "air, the other set exposed to air, light, and moisture, but shut off "from the electricity of the atmosphere. The result was unequivocal "and noteworthy, being from fifty to sixty per cent. in favour of the "plants left free to the air. It may therefore be taken as settled that "the electricity of the atmosphere plays a very important part in the "assimilation and nutrition of plants. Mr. Grandeau's conclusions "are accepted by the eminent chemist Berthelot, who at a subsequent "meeting, pointed out to the academy the significance of the fact, that "the free plants contained a *double* quantity of azotised matter."

Monsr. Montclar's opinion is, that the electricity of the atmosphere does not benefit the soil, or the roots of the plant under the present mode of working coffee or tea estates on the steep lands of the hilly countries of Ceylon and India. On flat lands of the plain, where there is *no wash* of the soil, the maintenance of fertility, independent of expensive manures, can only be insured by thorough agricultural operations.

Amongst these agricultural operations, the most important one is a thorough exposure of the soil to the air. That operation is not only necessary, but becomes an imperious necessity when all available matters of the soil are exhausted. This is done, in the plains, by deep ploughing and the turning up of the soil, but on steep lands, deep ploughing or digging of the soil so as to expose it to the air, is an impossibility, and hence the immense disadvantage of cultivation on such lands.

By his new combination of agricultural works, Monsr. Montclar has succeeded in converting that impossibility into a thorough possibility, and with his method, a new era of success is open to those who will follow his advice. Advice, particularly proper and good advice, is necessary to many who have engaged themselves in planting operations, without having made special agricultural studies. For newcomers to India, to Ceylon, or elsewhere, willing to start in coffee or tea or cocao, we recommend them to read and to follow carefully, the *works* as explained in the "Specification" of his method.

On that important point, we shall quote the "Specification" itself:—
"The most important question in opening an estate on steep lands, "and particularly on *very* steep lands, is to protect *completely* the "few inches of rich vegetable soil which compose the upper stratum "of the plot of land on which it is intended to conduct operations. "Without thorough protection, the rich surface soil which is the "result of the remaining decomposition produced during thousands of "years, will be washed away *entirely* by the heavy rains of one or two "monsoons. Is it not a calamity to lose by *wash*, in a few years, the "valuable richness provided by a bountiful Providence for the soil, "by the *decomposition* of thousands of years? In such a case, expensive "manures are immediately required, when, for several years to come, it "would have been possible for planters to gather good crops without "using expensive and often exhaustive manures."

But for *existing* estates, where large capital has been invested, the method of Monsr. Montclar, properly and carefully carried out, will be of immense value.

When with all sorts of obstructions put in the way of Monsr. Montclar by a few influential men, when without any *special* tools, which are indispensable—as admitted by Monsr. Montclar himself—he has been successful in giving satisfaction to several practical leading proprietors in Ceylon, we have no hesitation in stating, that ere long "Montclar's method" will be followed by all intelligent planters on the steep lands of India and Ceylon.

Above we have reported the series of experiments made by Mr. Grandeau, proving that the "electricity of the atmosphere" plays a "very important part in the assimilation and nutrition of plants"; and we have also reported that "Mr. Grandeau's conclusions are "accepted by the eminent chemist Berthelot, who, at a subsequent "meeting, pointed out to the academy the significance of the fact, that "the free plants contained a double quantity of azotised matter."

Besides the "electricity of the atmosphere" as above stated, Monsr. Montclar points out "the electric condition of the soil," which is entirely distinct from that of the atmosphere.

On that new subject of immense importance, we feel assured that the planting community of India and Ceylon will be grateful to Monsr. Montclar for the following valuable information:—

"In every place, where the coffee trees are poor, I always "found out that the 'electric condition' of the soil was *positive*, "when in every place where the coffee trees were very good, the "electric condition of the soil was *negative*. Such are positive "facts which can be ascertained by chemical analysis; but as "very few planters, in the interior of India or Ceylon, have "the chance of having a chemist at hand to perform such "analysis, I consider an *electro-meter* far better for planters, so that "they may ascertain easily whether the condition of such or such "lands or such spots of land are *positive* or *negative*. I have been "busily engaged in devising the best and simplest 'electro-meter,' "and when the *best* one is found out, the next question will be *cheap-ness*, and here, again, it is a matter of *unitas* amongst planters, "because 2,000 electro-meters can be made far cheaper proportionately "than one! The misfortune of the planters in India and in Ceylon "is the want of true *unitas* amongst themselves so as to secure not one "man for a short time, but permanently, a staff of practical scientific

"men of the highest talent, for studying and settling all difficult "matters connected with coffee, tea planting, &c. For instance, the "planters of Ceylon have engaged the services of Mr. Hughes as "chemical analyst for their soils. Mr. Hughes has done his analyses "very correctly, but what practical profit has resulted for the "planters? Nothing! Why so?—We shall see directly. Mr. D. Morris "has been engaged, also on behalf of the planters of Ceylon, to make a "*microscopic* examination of the *fungi* on the coffee leaves. He has "recommended a remedy for the cure of the leaves, but which, if success-"ful even, is impracticable from its cost! And besides Mr. D. Morris "did not mention how to cure the *other* diseases of the coffee trees, as "it is more important to cure *those* diseases than the 'leaf disease.' "From Mr. Morris's *microscopic* examination of the leaves, what "benefit will result for the planters? None! And that for several "reasons, the principal being, that by *microscopic* examination, it turns "out that generally *fungi* are on the leaves of the trees, exactly "as *animalculæ* are to be found in water and other liquids. And "another reason of importance is, that the planters should have "made arrangements so as to have several competent men of talented "*specialities* to work *together*, instead of allowing one after one to "work *separately*. Had they done so, as proposed by me in "1877, planters would have gained very much to their interest. "If a man, to be fully *dressed*, requires the tailor, the shirt maker, "the hat maker, the shoe maker, &c., it is absurd to think that one man "*alone* can redress the most mischievous agricultural derangements, "when it requires not less than five specialists of the highest talent, "all working together. The *causes* of the *negative* or *positive* condi-"tions of the soil are now to be studied, and that study alone, is a "gigantic one."

(To be continued.)

EDITORIAL NOTES.

FROM the Annual Report of the Mysore Planters' Association for 1878-79, we find that various important matters were discussed during the year, and that the Association gives evidence of a considerable amount of vitality. This is exactly as it should be, and it is a matter of surprise to us that the large number of gentlemen interested in tea have not formed themselves into an Association for the dissemination of new and improved methods of working, and generally for the purpose of making their importance as an industry felt, when subjects affecting their interests come before the public.

As we write, we learn that an influential meeting was held in London on 22nd July, at which this subject was discussed.

WE learn that Messrs. Collins & Co. are making some short ploughs, with a view to their being used in India. They are of sufficient length to enable the ploughman to twist the bullocks tail in the orthodox manner, will weigh thirty-three pounds, and will make a furrow 6 to 7 inches wide and 5 inches deep. We trust the price will not be beyond the reach of the Indian husbandman.

BENGAL seems to be the only presidency where agriculture is neglected. Madras stands at the head of all in this way. The North-Western Provinces are well looked after by Mr. Buck. We receive many reports from Mysore and the Central Provinces, and Bombay is taking rapid strides towards establishing agricultural schools. At the present writing we learn that an agricultural class has been opened at Nassick, through the exertions of the Collector, and that a graduate of the Sydapet Institution is in charge. The instruction is both theoretical and practical, two hours a day being spent in oral instruction, and on three days each week the students are taken to the field to see the ideas carried out; but what is Bengal doing?

FROM the annual report for 1878-9 of the Agri-Horticultural Society, Central Provinces, we learn that there is not much vitality in the operations of the Model Farm, and when one comes to look carefully into the record of their proceedings, this result does not seem altogether out of the way. The great drawback, so far as we can make out, which characterizes all these societies, is that they devote so little attention to improving the staple crops of the country. They are more taken up with introducing new hybrids of fruit trees, and the introduction of exotics, that they have no time to try and improve the cultivation of such crops and cereals, as form the granary from which the masses of the people are fed. The principal exception to this is the Sydapet Farm, on which are tried many valuable experiments of a thoroughly practical kind, and which cannot fail to result in improvement in the cultivation of our common crops, and in the quality of stock usually kept by ryots.

IRRIGATION in the North-West seems to be on the increase. From 1874-75 to 1877-78 the average extent of land under irrigation (rabi crops), was 754,338 acres, while in the season under notice it amounted to 1,075,952 acres, being an increase of 321,614 acres, or fully 42½ per cent. In the former series of years, the average charge per acre was Rs. 1-15-3. In the latter year it was Rs. 2-0-4, an increase of 3¼ per cent. It may be noticed here that the total cultivated area in the North-West for that season was 14,317,790 acres, consequently the quantity irrigated was only 7½ per cent. of the whole. May not the heavy charge be the reason for this? If the charge for the kharif crop be added to that for the rabi, we find the total to amount to Rs. 4-12-9 per acre. This sum capitalized at 10 years' purchase, is equal to Rs. 47-15-6. Now a good well will cost about Rs. 350, and as this would suffice for ten acres, the charge per acre would be Rs. 35, and besides the above sum of Rs. 4-12-9 is what the ryot paid *bonâ fide* to the canal department; no note is—or can well be—taken of the many small sums he was compelled to pay to the subordinate staff of the Irrigation Department, to the amla, the inspectors, the chaprassies. Any one having a knowledge of these departments and of their modes of working, knows that this is not exaggerated.

WE have pleasure in acknowledging receipt of the Sydapet Farm Manual and Guide, which we will notice more fully next month. The Government of Madras have acceded to Mr. Robertson's proposal that a considerable number should be circulated in the province, amongst that class likely to benefit by its perusal, *viz.*, the English-speaking tahsildars, revenue inspectors, &c.

EXPERIMENTS are being made by Mr. Benson, under the orders and at the suggestion of the Collector of Trichinopoly, having in view the demonstrating of the truth, that deep ploughing not only produces better crops, but enables the earth to resist drought. Doubtless they will be successful if properly conducted.

WE have received from Mr. Tupper, Under-Secretary to the Government of India, a copy of the report on the Kandesh Farm for half-year ending 15th July 1879. So far as this season is concerned, it tells us little further than that the crops which were put down are doing well. There seems to be great variety in the operations carried on at this farm, and the crops experimented with are, as a rule, those cultivated by the ryots. This is as it should be. We shall be pleased to hear further as to progress when the next report is issued.

FROM the report on the administration of the Madras Presidency for the year 1877-78, we find that a large amount of useful experimental work has been done. Speaking generally of Madras, we have no hesitation in saying that the experiments made under the auspices or authority of that Government are characterized by being thoroughly practical. They have their school of Agriculture and several Government farms, in all of which valuable experiments are being steadily carried on.

In the Ootacamund Botanical Garden, many medicinal plants are grown, as peppermint, digitalis, rhubarb, taraxicum, lavender, rosemary, ipecacuanha, and jalap. The cinchona plantations have been carried on in a scientific manner, and we find that samples of the various sorts have been sent home for analyses to ascertain which is the best species to grow. A further notice of this will be found elsewhere.

THE *Home and Colonial Mail* wonders why coffee, as an industry, is losing ground, as compared with tea, and mentions the fact that "the consumption of both is on the increase." This latter remark is true in one sense, but far from being so, from the point of view from which it ought to be examined. It is no doubt true, of both, that larger quantities are being retained for home consumption every year, but it is not true that larger

quantities of coffee are being consumed per head of population now than formerly; whereas, with regard to tea, the increase is steady both as regards consumption in the aggregate and per head. The following table will shew the quantities retained for home consumption in Great Britain :—

	Tea Consumption.		Coffee Consumption.	
	Total.	Per head.	Total.	Per head.
	lbs.	lb	lbs.	lb.
1847 ...	55,624,936	1·65	37,441,373	1 33
1857 ...	64,498,989	2·44	34,358,123	1·21
1867 ...	128,028,726	3·69	31,289,106	1·05
1877 ...	158,198,000	4·50	32,286,013	·95

From this it will be seen that coffee is losing ground in the United Kingdom at least.

FROM the annual report of the Agricultural Department of Madras for year ending 31st March 1878, we make the following extract :—

"Besides the well-established facts regarding the effects of trees "on climate, it must be borne in mind that abundance of fuel "means more manure for our arable lands, as the cow-dung now "burnt would be set free, and the ashes of the wood consumed "would also swell the manure heap." How is this affected by the remark made by Mr. Caird that the cattle of India are so poorly fed that cow-dung is practically useless *as manure.*

COTTON has been dethroned from its kingship in the United States, and now stands fourth in value in the list of primary articles produced from the soil, while the value of dairy products, and of pork when manufactured, are each nearly, if not quite, as large. Cotton of course still leads the list in foreign exports, and is likely to hold the first position in that regard for some years to come. According to the official report of the Agricultural bureau, the maize crop of 1878 was valued at 480,643,400, dols., wheat at 394,695,775 dols., hay at 271,934,950 dols., and cotton at 220,446,288 dols.

THE Parsees of Gundavi are exhibiting, says a correspondent of a native paper, great passion for agriculture. Many have given up their old callings and have taken up lands near Gundavi for carrying agricultural pursuit on an extensive scale. This passion seems to have increased since the visit to Nowsaree of Sir Richard Temple and his advice to follow this profession.

THE Bombay Chamber of Commerce, have issued a Circular with reference to the advisability of representing Indian produce and manufactures at the International Exhibition to be held in Melbourne in October 1880. The circular refers to the 15,000,000 lbs. of China tea annually consumed in the colonies, and points out that there is no reason why Indian tea should not also find a market there. Neither tea nor coffee—which are both largely consumed in Australia—are articles of export from Bombay; and as there appears to be a better prospect of opening up trade in them than in anything else, the *Bombay Gazette* urges the proposed Bombay Committee to place itself in communication with, the mercantile communities of Calcutta and Madras, so that all might work together.

SOME native gentlemen have issued a prospectus of the "Oriental Agricultural Association," capital Rs. 10,000, in 200 shares, of Rs. 50 each. The projectors have made arrangements to cultivate paddy, potatoes, sugarcane, &c., with a view of supplying the Indian markets with cheap produce. Lands where fertile soil and cheap labour can be procured at reasonable rates, have been secured. Only Rs. 10 a share will be called up at present, and subsequent calls will be made as will hereafter be found necessary, but no instalment is to exceed Rs. 10 a share. Reports of the operations will be submitted at the quarterly meeting of the shareholders, and printed for circulation amongst them.

The works will, we are told, be carried on on scientific principles.

SOME tea planters in Assam contemplate cultivating rice for themselves by imported coolies. There is a very large amount of land still available in very favourable situations for the cultivation of ordinary staples, and it is hoped that the projected railway will give a considerable impetus in this respect to the development of the district, which has undoubtedly a great future before it.

THE young olive trees imported from Italy by the Bishop of Agra, and planted at Mussoorie, have, we are told, thriven admirably and borne an abundance of fruit.

THE *Nineteenth Century* for July contains a startling account of our new wheat-fields in the great North-West, in which the writer, Mr. T. T. Vernon Smith, declares that the fertile belt between Canada and the United States, along the course of the two Saskatchewan rivers, contains 200,000,000 acres of "fine wheat land," and that farmers are finding that wheat-farming pays splendidly :—"A Mr. Dalrymple is quoted in the *St. Paul Pioneer Press* as having had in 1877, 8,000 acres under wheat, which yielded him all round 25 bushels to the acre, or over 200,000 bushels. His total outlay for seed, cultivation, harvesting, and threshing was under £2 per acre, leaving him a margin of £3 or £24,000 on his 8,000 acres." Men have been known in a single year to clear the cost of buying, fencing, and cultivating a farm, and there is a perfect rush of farmers, the "land office" in Dahkota, for instance, having sold 350,000 acres in the three dullest months of the year; while in Manitoba, on the Canadian side, the addition to the population in fine weather was calculated at 400 a day. So rapidly is population settling, that "the Winnipeg watershed," which is Canadian, will, it is calculated, within a few years produce 100,000,000 bushels of wheat—equal to the present import into Great Britain, and rendering her independent, of any foreign supply.

AN interesting report on jute and *malachra* fibres, by Mr. B. A. Gupte, Dr. McDonald's assistant at the Victoria and Albert Museum, has been published in English and Marathi for free distribution. Mr. Gupte sketches the local history of these plants, and explains in some detail the system of cultivation. The experiments which he enumerates seems to justify his assertion that jute and *malachra* could be grown in the Bombay Presidency in abundant quantities :—

"European officers, who have been taking pains to improve the agriculture of this land, have placed before us the discovery that these plants can be successfully cultivated here, and have also explained to us the mode of extracting fibres from the plants they recommend. After imparting to us such valuable information, it is but natural that they should expect us to try, practically, the conclusions they have arrived at, and thus confirm their anticipations of Bombay indigenous jute, producing bale cloth for the use of the numerous mills in this city, and thereby outbid the Bengal product, on which our mill-owners and others have at present to depend for its supply. Complete apathy towards this useful industry will most certainly merit censure from all civilised nations. We may, then, be safely compared to the two sluggards who starved themselves to death under a fruit-tree with its branches bent under the weight of the ripe fruits they had on, because they tried to excel each other in their idle habits."

MR. DYER, Assistant Director of the Royal Gardens at Kew, in a letter to the India Office acknowledging receipt of the collection of forest produce presented to the Museum of Economic Botany by the Government of India, says : "During the past winter the officers in charge of the Museum have been occupied under my supervision in unpacking, examining, and incorporating the specimens with our permanent collections. This work is now finished, and Sir Joseph Hooker is able to speak with the highest satisfaction of the efficient manner in which the energy and knowledge of the Indian Forest Department, supported in this matter by the liberality of the Indian Government, has enabled the woody vegetation of India to be illustrated in our museums in a way which is not paralleled in the case of any other British Possession."

A COMMITTEE has been formed, of Mr. E. C. Buck as President and Messrs. W. Duff Bruce, C.E., and Angus Campbell, members, to conduct the competition for a prize, which was offered in 1871, "for the best machine or process for the separation of the bark and fibres from the stem, and the fibre from the bark, of the Rhea or Ramie plant." Only 24 applications for leave to compete have been received. The trial begins on the 13th of September

and takes place at Sahatanpore. There is no native member on the committee. The general conduct of the trials will be much the same as in 1872, but the settlement of details connected with the working of the machines will be left to the discretion of Mr. Buck, whose decision in all matters will be held to be final. A ton of the fibre turned out by each of the machines that are considered by the judges to be deserving of the prizes offered, will be transmitted to England for valuation.

COMMUNICATED AND SELECTED.

WELL CULTIVATION.

WE are not aware if the system of well cultivation so common in the Jaffna Peninsula, is practised to any extent in India, though it would seem more than probable that it was originally introduced from the South of India by the early Malabar invaders of the island. The system is at any rate spoken of in the *Calcutta Review* as a novelty, possibly in regard only to the locality where it was introduced: but the *Pioneer* in noticing the article in question, is equally warm in its praises as a system likely to benefit native cultivators, and therefore deserving of every encouragement.

In noticing the article in the *Review*, our Allahabad contemporary mentions this system of well cultivation as having been quietly worked out in the district of Sarun in Lower Bengal. The author of the scheme is neither an engineer nor a civilian, but a sub-Deputy Opium Agent, who, taking advantage of certain rules of his department, has during the past five years constructed 2,500 new masonry wells and repaired 300 old ones, at an average cost to the State of between three and four rupees a well. The actual expenditure was Rs. 77,000, but the whole of this amount has been recovered. It was advanced in sums of about Rs. 50 for each well, and the loss to Government is the interest, which the reviewer calculates at 4½ per cent. to amount, during the two years and a quarter in which it is being recovered, to Rs. 3¾. Further on we learn that during the present year 420 new wells are being made and 45 old ones repaired. The wells are constructed of dry masonry, cost seemingly from Rs. 80 to Rs. 120 each, and are expected to last a hundred years. Mr. Tytler states that he is usually able to induce the zemindar to supply the wood for brick burning, whilst the ryot gives fifteen or twenty rupees besides *his* labour. Indeed the most notable circumstance of the system is that it works through this combined self interest and independent action of the landholder and tenant; the tie uniting these two ordinarily opposing forces being the personal influence of Mr. Tytler. The effect of these wells on general cultivation when poppy is not on the ground is said to be very great. The reviewer seems to seek specially to draw attention to what he regards as the successful result of honest unpretending hard work. His claim to notice is not unjustified by the facts.

Unfortunately, the summary of the *Calcutta Review* article supplies no particulars as to the nature of the soil or the depth to which the wells were sunk. In the Jaffna Peninsula, where we know that the system of well cultivation is extensively and successively carried on, the soil is light and easily worked, and we believe the late Mr. Russell, when Government Agent of the Northern Province, applied to the Government for a vote of money for this purpose at the rate of five pounds a well, and so convinced was he of the utility and economy of this means of irrigation, that when the money was refused by Government, he commenced expenditure out of his own private means; but unfortunatly for the district he was promoted to the Central Province before he could carry out much of his plan.

One great advantage which well irrigation offers is, that it furnishes a supply of water throughout the year; but very rarely indeed if the wells be sunk to a proper depth, will the water supply fail altogether. Now we have seen in certain districts of this Island, how expenditure on village tanks has proved of no avail during seasons of extreme dryness; and engineering ingenuity has been taxed, and extensive and costly schemes have been devised, for bringing a supply of water to them from considerable distances in order to obviate the effects of the absence of rainfall during the most critical times of the year. We have an instance of this in the project of the Yoda Ella irrigation works in the North Central Province, estimated to cost £40,000, but the expenditure is so large that Government hesitates to sanction a vote for this purpose, knowing well that once begun the work must be continued to the end, and that it is possible this amount may be considerably increased even after the most careful estimates. The question naturally arises in this case, whether instead of entering upon a large outlay, an attempt might not be made by the construction of wells and lifting apparatus, to obtain a sufficient supply of water to meet the occurrence of dry seasons.

The same remarks will apply to certain districts of the North-Western Province, where the cost of constructing works for irrigation purposes on the ordinary system is often found to be in excess of any probable returns. The cost of sinking a well will of course depend on the nature of the ground and the depth to which it would have to be sunk, and it would of course happen that in some localities, where large masses of rock was found, that the sinking of wells would be impracticable, but careful borings would settle all these questions: and we have brought the subject forward in the hope that the success which has attended irrigation by means of wells in Bengal, equally with the system in the Northern Peninsula, may be the means of inducing the authorities to turn their attention to the subject, before any further large expenditure be incurred in the construction of irrigation works upon the old system.—*Ceylon Times.*

THE PLANT-PRODUCING CATERPILLAR OF NEW ZEALAND.

(FROM THE COLONIES AND INDIA.)

AMONG the many curious forms of animal and vegetable life at the antipodes, perhaps none is more remarkable than the Aweto, or vege-caterpillar, which is found in considerable numbers in certain parts of New Zealand, and less frequently, in a somewhat different shape, in New South Wales. In the body of this caterpillar literally grows the root of a species of rush or reed, whose stem, growing upwards in the ordinary manner above ground, is the perfect stem of a leafless vegetable with a head somewhat resembling the head of a bulrush. The heads, or seed vessels of the plants, are eaten by the Maoris, and, when burnt, are employed as a colouring matter; the plant when roasted emits a strong animal smell. The natural history of this curious organism is briefly as follows:—The caterpillar known as the "Aweto," or *Hipialus virescens*, when burrowing underground previous to its metamorphosis to the chrysalis state, collects one or more of the seeds of a parasitic fungus (*Sphæria Robertsii*) in the joints of its neck, where, nurtured by the warmth of the body, they quickly germinate, the roots pressing downwards and completely filling the skin of the caterpillar's body, and the stem springing upwards through the light rich soil till it attains a height of some eight or ten inches. The caterpillars seldom or never exceed three or four inches in length, and the root of the plant appears invariably to confine itself to the shell of the insect, which preserves its outward form intact, the feet, eyes, and scales appearing perfect. Wherever the clubshaped heads of the plant are seen, its caterpillar-root may easily be found by digging carefully downwards to a distance of several inches. This remarkable instance of a caterpillar, naturally destined to develope into a gaudy butterfly, transforming itself into an integral and radical portion of an insignificant plant, seems like a protest against the ravages which these larvæ usually commit on the produce of the vegetable kingdom.

THE VINTAGE OF 1879.

A FEW weeks ago, according to our usual custom, we sent out circulars to the various vinegrowers in the colony asking them to furnish us with as much information as they could respecting the vintage which has just closed. The bulk of the replies having come to hand, we are in a position to give an approximate idea of the results of the season. In some respects the figures and statements are satisfactory, although they do not indicate any increase in the production of wine this year as compared with last. The circulars returned give a total yield of 340,400 gallons, but as two or three large manufacturers have not furnished us with any information this season, we shall not be far out if we estimate the gross production at something like 390,000 gallons. This is nearly 26,000 gallons less than the returns for 1878, but about 84,000 gallons in excess of the returns for 1877. We are unable to tell to what extent the acreage under vines has increased, as we have no record of last year's figures; but our returns show that from 20 to 30 acres which produced nothing last year are now bearing, the total area planted being 1,230 acres. This represents only the vineyards about which information has been supplied us; there are a number of small plots of ground planted with vines not included in our returns, so that the total acreage under vines throughout the colony would be considerably in excess of that mentioned above.

It is satisfactory to find no allusion in any of the circulars to the appearance of *Phylloxera vastatrix*. There was a rumour early in the season that this much-dreaded scourge had shown itself in one of the southern vineyards, but we are glad to find that, so far as our correspondents are aware, no traces of the disease have been seen. Of the *Oidium tuckerii*, which played such havoc with the vintage of 1877, we do not hear so much this season. Most of the vineyards have escaped this pest. It appeared, however, among the vines in the North, North-East, and South, but where effective sulphuring was employed, little damage resulted. This is the general testimony, although one or two growers say they tried the application of sulphur without avail. The disease principally appeared among the Verdelho variety of grape, but

here and there the Cabernet, Shiraz, and other sorts were affected. Mr. Hardy reports that he found the spreading of sulphur at the roots of diseased vines did almost as much good as blowing it on the plants with the bellows, and he is so convinced of the efficacy of sulphur, that he says vinegrowers need not fear if they have no worse enemy than the *oidium*.

The large wine-makers are doing all they can to consolidate and extend their business, and in addition to the employment of the produce of their own vineyards, they do a great deal in the purchase of fruit from small vinegrowers. This is leading many farmers to turn their attention to the cultivation of wine grapes, and we hear that several persons in the North are giving up the production of wheat with a view of growing vines. During the season just closed as much as from £4 to £6-10*s*. per ton was paid for grapes; and it will be at once seen that a ton of grapes to the acre at say £4 per ton is far better than seven or eight bushels of wheat at 5*s*. per bushel.—*S. Australian Register*.

SALT AND SALT FACTORIES.

THERE are few articles at once so common and so interesting in one way or another as salt, to which, according to a reply to a deputation given by Mr. Sclater-Booth a few days ago, public attention is likely to be once more specially directed. The salt-makers of Cheshire have for many a long day had things pretty much their own way, and are said to have been making themselves somewhat of a nuisance to their neighbours in two or three respects, one of the most serious complaints being that they have been pumping away the very foundations of things in that part of the world. While they have pumped up their brine and enriched themselves, they have been ruining their neighbours by drawing off tens of thousands of tons of solid matter every month from beneath adjacent property, which has consequently sunk down and wrecked buildings and entailed other ruinous results.

What is the yield of salt from Cheshire at the present moment we cannot say precisely, but a return before us for 1874 shows that from the 1st of January to the end of October in that year the quantity that passed down the river Weaver to Liverpool from the salt district was 717,378 tons; and when it is remembered that the mines here are said to have been of great importance in the times of the Saxon Heptarchy, it will hardly be thought a matter for surprise that if there are any objectionable features in connection with this produce, they are by this time calling pretty loudly for remedy. The salt works of Cheshire appear to be carried on by a double system. By one the solid rock salt is quarried out just as coal may be. In this form it has to be dissolved in water from which it is afterwards separated by evaporation. In Polish Gallicia, where there are the most celebrated salt mines in Europe, this refining process is dispensed with, partly because the salt is really purer, and partly, perhaps, because the consumers of it are somewhat less fastidious than some of the rest of us. In these mines the rock is quarried out and pounded into powder, and is then ready for use. The refining process of Cheshire and Worcestershire renders English salt a subject of very general admiration to foreigners, who prize it very highly and use it in enormous quantities, notwithstanding that taxation is in many cases very heavy, and notwithstanding the further fact that few regions of the earth are destitute of salt of their own in some form or other. There are, however, many parts in which, although salt is within easy reach, it is scarcely abundant enough to pay for its collection. There are saline springs in certain parts of Germany, for instance, the salt of which is so small in quantity, that it was long thought to be better to import it at a high rate than to attempt to make any use of the home supply. The cost of the fuel employed in the process of evaporation was greater than the value of the salt when obtained. At length a very ingenious artifice was hit upon. The proprietors built up huge piles of faggots, on to the top of which they pumped their brine, allowing it to percolate down under the influence of sun and wind. Only the water, of course, passed off by evaporation, leaving every particle of the saline matter behind. By this means it was found that when it reached the receptacles underneath the faggot stacks, the proportion of salt to water had been so largely increased, that it paid very well to complete the process by artificial heat. A similar expedient has, we believe, been adopted at certain salt springs in Sardinia.

Besides the excavation of the solid rocks, the good people of Northwich and other places in Cheshire get an enormous quantity of their salt from the earth by pumping up brine, which is usually found at a depth of about 30 yards. It is formed, no doubt, simply by ordinary springs of fresh water passing over the rocks of salt in which the neighbourhood abounds, and thus becoming saturated, every pint of good brine containing, it is computed, about six ounces of salt. It is easy to perceive that by this process long continued, a man may very effectually run away with the rocks on which his neighbour's property is based. In the process of excavation he knows, or may know, precisely where he is obtaining his supplies from; but where his brine is drawn from is a more difficult matter to decide. Whose foundation rocks he may gradually be sapping can be determined only when somebody's house begins to totter and crack, and even then the unlucky owner would find it somewhat difficult to prove that any one pump in particular was doing the mischief. The damage seems, as a matter of fact, to have long been submitted to as altogether inevitable, and some of the places in the valley of the Weaver present a singular scene of dilapidation. Northwich in particular has been a great sufferer; and it is apprehended that if pumps are continued at work with their present vigour, the whole town, or a great part of it, must before long sink to a level below that of the river Weaver. Already many of the houses appear as though they have suffered from an earthquake, and are only prevented from falling by an elaborate system of butts and screws. The brine as it comes from the earth is pumped into a reservoir from which pipes in various directions convey it to shallow iron vessels, from 40 to 100 feet long and from 10 to 35 feet wide, or thereabouts. Under these pans great fires are carried through flues terminating in lofty chimneys, which, we presume, are to be the special objects of Mr. Sclater-Booth's interest in connection with the Noxious Vapours' Bill. As the brine is heated a slight film of salt continually forms at the top of the liquor and sinks to the bottom, where, ultimately, all the saline matter is deposited in a thick cake, with more or less of impurity encrusted with it at the bottom. Various kinds of salt are produced from one and the same liquor by applying different degrees of heat; or, rather, it will be more correct to say that the salt in the brine may be crystallised into various commercial qualities of salt by such variations of the heat employed. Coarse-grained salt is produced by 130 degrees of heat, "fishing salt" by 100 degrees, and so on.

The taxation of salt would form a curious chapter in the world's history. It is computed, from prison and union work-house statistics, that the annual salt consumption for each person is about 16 pounds, and it has been asserted that this is probably very near the consumption necessary for people generally in this country. When Mr. Crawford was before a Select Committee of the House of Commons in 1833, he put twelve pounds per head as the rate of salt consumption in India. Even allowing this quantity, which is probably a good deal less than the rice-eating Hindoo would take if he could get it, it was shown that from 1765 to the time when Mr. Crawford gave his evidence, a native of India could get twelve pounds of salt in the course of the year only by sacrificing one-sixth of his average income. Not a great while ago it was calculated that the Empire of Austria derived no less than one-seventh of its total revenue from its salt mines. That excessive import duties on salt must be attended with very pernicious results is a fact that has been very practically recognised by our own Government, but perhaps the most startling illustration of the fact that it would be possible to adduce is to be found in the old criminal law of Holland, by which it was decreed that criminals convicted of murder under certain circumstances should be imprisoned in a damp cell, have only water to drink, and should be fed with bread made without salt. According to well-authenticated testimony, the criminal always died within a very short time, and that by a death so loathsome and horrible that its symptoms cannot very well be described.—*Globe*.

OATS.

(BY S. BOWICK.)

THE following, from a forthcoming "Agricultural Handkook for Schools" (published in the *Agricultural Gazette*), will serve to illustrate the steps being taken at home to diffuse agricultural knowledge :—

1. Avena.—This important grain is peculiarly adapted for temperate climates, and, being a hardy plant, it is better suited for poor soils and cold climates than either wheat or barley, and is consequently more easily cultivated. The late Mr. Patrick Shirreff, whose name is well known in connexion with cereals, was of opinion that by their improvement the corn-growing area of Great Britain might be greatly enlarged. He doubtless expressed himself too sanguinely when he said that with earlier varieties of oats, the home of the grouse and deer might yet be invaded; but the reverse process of laying down to pasture instead of adding to the arable surface is now more the order of the day. Friable soils are well adapted for oats, but they are grown on stiff clays, as well as mossy and gravelly soils, and, in fact, upon all descriptions of ground. Oats are a gross feeding plant, and in this characteristic they exceed wheat and barley, and they require a larger amount of moisture than either; but a wet and cold summer, unless with the earlier varieties, leads to an untimely reaping time and a deficient harvest. They thrive best where a large quantity of vegetable matter is present in a state of decomposition, and they are very generally taken as a first crop on newly-reclaimed land. Oats are also a common crop on grass lands—*i.e.*, rye-grass mixture—after pasture, and on that the best crops are grown, both in respect to quantity and quality,—the older the pasture the better the crop. In Scotland oats occupy three times the area of wheat and barley together, and in Ireland the ratio is four to one; but though oats prosper in a cool and moist atmosphere, it is noteworthy that Irish oats are rarely the quality of those grown in Scotland. In the north of England the proportion of oats is also large.

2. Seedsmen enumerate 30 or 40 varieties of oats, but many of them have little of a distinctive character, and others of them have become all but extinct. The kinds that maintain the best repute are the Poland (formerly the Georgian) Potato, Hopetoun, Angus, the Blainslie, Tartarian, Sandy, Tam Finlay, the Red and Dun oat, and several kinds brought out by Mr. Shirreff. The Potato oat takes a high place—it has a plump mealy kernel, and is cultivated on the best land; but the straw is rather short compared with other kinds. The Hopetoun oat has a longer grain with awn, it ripens about the same time as the Potato oat, and is not so liable to shed. The straw is longer and not apt to lodge, but on indifferent soils the yield is sometimes disappointing. The Poland and Canadian oats are husky, and although they grow bulky crops of a heavy weight by the bushel, their cultivation is not extending, except in certain districts. A friend in

Renfrewshire had some seed of the Canadian from North Warwickshire some time since, which weighed fully 50lb. per bushel, and which produced early and large crops in the north, but in consequence of their rapid degeneracy, and the necessity of frequently renewing the seed, their cultivation was abandoned.

3. The Sandy, the Blainslie, and the Tam Finlay are all useful oats for the general run of soils. The latter is the best established oat in the south-west of Scotland, it yields fine fodder, and a good return of corn; but the recently-introduced Swiss oat, which has a like character, is highly spoken of. The white and black Tartarian oats are good yielding kinds, although somewhat light in the bushel. They both carry the ear on one side, are long in the straw, and well adapted for soils of a black mould, and of a peaty and marshy description. There are several kinds of winter oats, which are cultivated in the south of England, that have more or less merit, and have the advantage of being harvested early.

4. The earliest varieties are best suited for the higher class soils, and what are indefinitely called common oats are adapted for indifferent lands and climates, being hardier and better able to resist atmospheric changes and less liable to shed their seeds in high winds. A change of seed is preferred from land of a clayey description, and from an early district. Oats do not degenerate so rapidly on that kind of land, but for light land a change of seed is advantageous every three or four years.

5. Some varieties of oats are of long standing, and may be traced to a single ear or plant, which was propagated by the discoverer till enough was gained for extended field cultivation. The Blainslie oat is among the oldest, and it was originated on a farm of that name in the high grounds of Tweeddale, about the middle of the last century. It consisted of a few stalks, and was picked from a moorish field of common oats on account of its earliness and abundance of straw. It soon came into great demand on both sides of the Tweed, and it has kept up its repute to the present day. The fine strain was kept up on that farm by always selecting the best ears to propagate from without change from other places. Again, the Potato oat was discovered amongst a field of potatoes on the farm of Ackleby, Cumberland, in 1788, and it soon nearly supplanted the Polands and Tartarians. The Sandy oat was found by a boy named Alexander (*Scotice*, "Sandy.") Thompson, on a recently-formed bank of soil on the farm of Noth, parish of Rhynie, Banffshire, in 1824. It is a hardy, well-established kind; it resembles a red oat which was introduced into the north from Peebles in the end of the last century, and may claim to be a descendant, but in the course of 30 years it has lost a good deal of its red colour.

6. The oats cultivated a century ago in most of the ill-circumstanced parts of Britain were lank-tailed, grey-awned, and of a very thin and poor description. Dr. Keith writes, in the beginning of the present century, that before the great frost of August in 1782, the native oat did not weigh over 20lb. or 30lb. per bushel, and did not yield more than a half of the meal now obtained from the same measured quantity—a quarter of oats would only produce 80lb. or 90lb. of meal, instead of the 180lb. or 190lb. of the present day. The damage sustained by the frost of 1782, and the calamitous harvest of 1799, nearly extinguished the ancient native oat in the north, and led to the introduction of superior kinds, much to the advantage of the husbandman.

Some years ago we had a sample of oats from North Yell, a native island of the Shetland group, which, we believe, was identical with the native oat referred to. Some of them were sown in the south midlands of England, and produced large plants; and some were transmitted to Professor Buckman, of Bradford Abbas. There they also expanded into fine plants without showing much improvement in the kernel. They were the Avena strigosa, which Dr. Lindley supposed may have been the parent of our oat crop. The Avena fatua was also experimented with by the professor, and he was led to the opinion that to it must be ascribed the origin of the cultivated oat.

7. As previously mentioned, oats are sown thicker than either wheat or barley, and four to five bushels an acre are the common quantities employed. There is a medium quantity for farms and districts, from which it is not profitable to deviate materially, and the very thin seeding practised by the few will never be adopted by the many. In combating the thin seeding, Mr. Almack justly remarked 30 years ago that the saving of a bushel per acre was a great saving; but few could fail to see how much greater the loss would be if all the land were sown with a bushel less per acre than the season following proved to have been necessary. The average yield of the best corn counties ranges from 48 to 52 bushels an acre, and occasionally 90 to 100 bushels an acre is reaped from wealthy fields. The months of March and April are the common seed time.

8. Oats are better to be cut before they are fully ripe, say about two-thirds ripe. The straw of oats is far better fodder than wheat or barley, the earlier cut the better, and some kinds of straw are little worse than hay. Oats are almost universally cut with the sheafing reaper, and put up into stooks to win. Under leaky skies in late districts there is no better way of saving the crops, after being a few days in the stook, than building them in small stacks in the field, the builder standing all the time on the ground.

9. The finest strains of oats weigh 44lb. and 45lb. per bushel, and the common qualities run from 40lb. to 42lb., and thin sorts 36lb. to 38lb. Oats weighing 41lb. per bushel are estimated to yield about 186lb. of meal from the quarter on the average. Oats weighing 45lb. per bushel produce about 228lb. of meal per quarter, from which it will be seen that the extra weight of fine oats is nearly all convertible into meal—the heavier the weight per bushel the greater the proportion of meal.

In milling oats, or converting them into oatmeal, they are first kiln-dried, and after cooling for some days, they are shealed to take off the husks. The kernels are again passed through the millstones, which are now placed so close as to grind them into meal of the fineness wanted. Great improvements have been made on the primitive mills in use 40 or 50 years ago, by which very much manual labour is saved; in fact, like the improved threshing-machines, the meal leaves the machine ready for weighing up.

Oats are still the bread-corn of Scotland, though not nearly so much used as formerly. Oat-cake and "Scotia's halesome porridge" formed two-thirds of the food of all classes at an earlier period, and they were a more substantial food than the tea and flour-bread that are now so much in use. A comparison of beef with oatmeal has lately gone the round of the newspapers, in which it was stated that 100lb. of beef contained 70lb. of water, while in the same weight of oatmeal there was 91lb. of solid matter. The 30lb. of solid matter in beef consisted of 21lb. of flesh-formers and 8lb of heat-givers; and the solid matter of meal yielded 12lb. of flesh-formers and 77lb. of heat-givers, so that the latter was deemed very beneficial in a cold climate.

An agreeable, light, and wholesome dish, called sowens, as prepared from the husks of oats, or rather the fine flour adhering to them, was very much used in the last and preceding generations, and is not yet entirely discontinued in the north. The seeds, as they are called, are steeped in water till they become a little acid, and the water on the top is then poured off. The remaining thick liquor is then separated from the hulls by a sieve, and is either half boiled and drank under the name of knotting sowens, or completely boiled into a pudding, and eaten with sweet milk. An excellent drink is also prepared from oatmeal by pouring boiling water over two or three spoonfuls, and then stirred. After the mixture settles, the water is poured off, and then drunk as tea. It is the best of drinks; in feverish sickness it is unequalled, and it alike quenches the thirst and nourishes the system. The greater part of the oats, however, are used for horse food, and they make very good food for fowls.

INDIAN TEA DISTRICTS ASSOCIATION.

In a recent number of the Planters' Supplement, we foreshadowed the probable formation in London of an Association having for its object the guardianship of the interests of Indian tea-planters. We now have before us the prospectus of the Indian Districts Tea Association, which we reproduce below. The enterprise is one which at once commends itself to those interested in the cultivation of tea in India. At the present time, when planters are beset with difficulties which the unremunerative prices of tea serve to aggravate, it specially behoves them to take united action in respect of their many grievances. There is vast scope for the operations of the proposed Association, and although it may not be able to immediately accomplish all that it aims at, should it succeed in placing the laws which regulate the labour question on a better footing, it will not have laboured in vain. A glance at the names of the gentlemen forming the provisional committee will satisfy planters in India that their interests at home are in good hands.

The following is the prospectus with reference to which a meeting will be held on the 22nd instant, at the Guildhall Tavern. Tea planters in India desirous of joining the proposed Association should communicate in the first instance with the honorary secretary of the Association, at 14, St. Mary Axe, E.C.

The great and continuous development of the growth of tea in India, the magnitude of the interests involved, and the numerous difficulties—some natural, others the effect of well-meant but mistaken legislation—which stand in the way of the future expansion of the industry, and to some extent even imperil its existing stability, indicate the expediency, not to say urgency, of those interested in the success of the enterprise, forming some kind of association for the better protection of their common interests.

The large field covered by the industry, embracing as it does, several districts widely separated, and the comparative isolation of individual planters, would render it difficult to organise and effectively sustain such an Association in India. The tendency, too, on the part of owners and others connected with the enterprise to gravitate, so to speak towards London, points to that city as the fittest and most convenient location for the head-quarters of the Association. At the same time, the co-operation of planters and others resident in India having kindred interests, would not only be most valuable, but almost indispensable to the support of the Association, and the realisation of its objects. The more important of these objects may be summarised as :—

1st.—To serve as a centre or medium of intercommunication to those directly or indirectly interested in the cultivation of tea in British India, and to collect and disseminate information calculated to be of service to that interest.

2nd.—To endeavour to bring about a certain degree of concert and unity of action amongst owners and managers of tea property upon all important questions having for their object to cheapen the cost of production, improve the quality, and increase the demand for the product.

3rd.—To watch the course of legislation in India and England, in so far as it affects the tea industry, and the general interests of the districts in which that industry is prosecuted, and to procure such amendments and modifications of existing laws as may be found necessary for the realisation of the objects in view.

4th.—To take such action as may be found needful to improve the means of communication and transport, and to promote a fuller and freer stream of immigration, both of labourers and settlers, into such of the tea districts as most require it.

The province of Assam, for instance, with millions of acres of waste land of the most fertile character, and a climate that may be said never to fail in its rainfall, presents in itself a vast and most suitable field for the latter class of immigrants, being, in fact, marked out by nature as one of the most productive grain-growing countries of the world.

While fitted in this respect to be a feeder to the rest of India, and a potential factor in warding off famines and mitigating their effects, the actual rice crops of the province fall far short of the quantity required to feed the large body of labourers and their families located on the tea plantations, thus necessitating a perennial drain from other parts of the Empire, and imposing a heavy tax on the employers of labour.

Tea culture in India is supported essentially by British capital, and only requires a fair field and judicious encouragement to become the most valuable industry of the country, giving steady and remunerative employment to many thousands of labourers, and aiding materially in sustaining the revenue of the Government. If there has been any failure on the part of the Government adequately to appreciate the value of this boon to India, and the difficulties those engaged in the enterprise have to contend with, and which have been to some extent intensified by legislation needlessly stringent and costly in its incidence, it may fairly be imputed to the want of sufficient information, and the absence of combined representation on the part of those interested.

As an illustration of the correctness of this view, and of the probable utility of an Association of the nature of that proposed, it may be stated that last summer Mr. Holliday of the firm of Messrs. Lister and Co., of Bradford, sought the co-operation of several other gentlemen, interested commercially and otherwise in the prosperity of Assam, in forming a deputation to wait on Lord Cranbrook, her Majesty's Secretary of State for India, to represent, amongst other matters affecting the interests of the province, the difficulties connected with the importation of labourers and means of communication and transport. The deputation was introduced by the Right Hon. W. E. Forster, M.P., and Sir H. W. Peek, M.P., and was most courteously received by his Lordship, who promised that their representations would receive his best attention, and be communicated to the Government of India. This promise has been duly fulfilled, with the result that the sanction of the Government has been obtained for the construction of 70 miles of railway in the Debrooghur district, with the guarantee of an annual subvention to the amount required to assure a minimum interest of 5 per cent. on the estimated outlay for a period of five years. This, though a partial and very inadequate relief, affecting only a small section of a large province, may be accepted as an indication of the disposition of Government to meet the reasonable views and wishes of the planting community when properly represented.

The following gentlemen have already consented to act on the provisional committee, and several other gentlemen are being asked to join, in order to make the committee as representative as possible:—

Andrew, A. (of the Mungledye Co.)
Bird, S. (Tingri, Assam).
Bird, P. (Tingri, Assam).
Braddon, W. C. (of the Luckimpore Tea Co.)
Burkinyoung, H. (of the Jorehaut Tea Co.)
Burkinyoung, John A. (of the Jorehaut Tea Co.)
Burn, Major-General H. P. (of the Lebong Tea Co.)
Capel, A. (Arthur Capel & Co.)
Carpmael, G. (of the Noakacherra Tea Co.)
Cowan, James, M.P. (Edinburgh.)
Forsyth, Sir T. Douglas, K.C.S.I., C.B. (late Commissioner of Punjaub.)
Gray, J. J. (Doolahat, Assam.)
Holl, F. W. (of the Dejoo Co).
Holliday, A. J. (of Lister & Co., Bradford.)
Hopkinson, Colonel (late Commissioner, Assam.)
Hudson, John (Jhanzie Tea Association.)
Knowles, Herbert (late of Geo. Henderson & Co.)
Lawrie, Alex. (Balmer, Lawrie and Co.)
Leith, John Farley, Q.C., M.P. (of Darjeeling Co.)
Lepper, Charles (Erin Baree, Assam.)
Lyell, Robert (Geo. Williamson and Co.)
Mackenzie, H. D. (of Hatigor, Assam).
Makintosh, J. (of Naho Habi, Assam.)
Maitland, Wm. (of the Assam Co.)
Martin, J. A. N. (Borelli Co.)
Potts, H. H. (Luckimpore Tea Co.)
Potts, R. U. (of Upper Assam Co.)
Riddell, J. (of Badulipar, Assam).
Roberts, J. W. (of Tiphook Co.)
Roberts, W. (of the Jorehaut and Darjeeling Companies.)
Sangster, W. (of Darjeeling Co.)
Simpson, H. J. (Balmer, Lawrie and Co.)
Stuart, J. (Jas. Harber, Son and Co.)
Thompson, Dr. (Morans and Co.)
Thompson, W. J. (of W. J. and H. Thompson.)
Thompson, A. (of W. J. & H. Thompson.)
Todd, J. E. (Meleng Estate.)
Wahab, Edward (Alex. Lawrie and Co.)
Warren, James (Doom Dooma Co.)
Williamson, C. E. (Seleng, Assam.)
Williamson, Geo. (George Williamson and Co.)
Williamson, J. H. (Williamson, Magor & Co)

Alex. Lawrie, Hony. Secy., *pro tem*

—*Home and Colonial Mail.*

A NUMEROUSLY attended and influential meeting of the proprietors of estates, merchants, and representatives of the Calcutta Agency firms, and others interested in the growth of tea in India, assembled at the Guildhall Tavern, Gresham-street, for the purpose of considering, and, if approved of, forming an association for the protection of their joint interests.

The tea-planting interests were well represented in all their branches, and while unanimity characterised the proceedings throughout, a deep interest was evinced by all present in the objects for which the meeting was convened.

Amongst those present were Colonel Hopkinson, Dr. F. N. Macnamara, Dr. Wm. Thomson, Messrs. Herbert Knowles, Geo. Williamson, Wm. Roberts, W. J. Thomson, Alex. Lawrie, R. B. Magor, R. U. Potts, Harold S. King, H. Burkinyoung, Frank Holl, Arthur Wheeler, Robert Lyell, Alfred Holliday, J. H. Williamson, Wm. Sangster, B. Grindrod, Knight, S. Ward, F. O. S. Reade, W. Spink, Samuel Bird, Paul Bird, W. T. Carnegy, Parke Pittar, J. T. Roberts, Edward Wahab, R. A. Lawrie, John Hudson, J. Carpmael, C. E. Williamson, E. Tye, John Mackintosh, Arthur Thompson, F. Parker, C. Lepper, C. Bergman, Dr. MacDonnell, &c., &c.

On the motion of Mr. George Williamson, seconded by Mr. Wm. Roberts—

Sir T. Douglas Forsyth, K.C.S.I., C.B., was unanimously voted to the chair.

The circular, on the basis of which it was proposed to form the Association, was produced by Mr. Alex. Lawrie, the hon. secretary. It stated that the great and continuous development of the growth of tea in India, the magnitude of the interests involved, and the numerous difficulties—some material, others the effect of well-meant but mistaken legislation—which stood in the way of the future expansion of the industry, and to some extent even imperilled its existing stability, indicated the expediency of those interested in the success of the enterprises forming some kind of association for the better protection of their common interests. The large field covered by the industry, embracing as it did several districts widely separated, and the comparative isolation of individual planters, would render it difficult to organise and effectively sustain such an association in India. The tendency, too, on the part of owners and others connected with the enterprise to gravitate, so to speak, towards London, pointed to that city as the most convenient and fittest location for the head-quarters of the association. At the same time the co-operation of planters and others resident in India having kindred interests would not only be most valuable, but almost indispensable to the support of the association and the realisation of its objects, the more important of which were, first, to serve as a centre or medium of communication to those directly or indirectly interested in the cultivation of tea in British India, and to collect and disseminate information calculated to be of service to that industry; secondly, to endeavour to bring about a degree of concert and unity of action amongst owners and managers of tea property, upon all important questions having for their object to cheapen the cost of production, improve the quality, and increase the demand for the product; thirdly, to watch the course of legislation in India and England, in so far as it affected the tea industry and the general interests of the districts into which that industry was prosecuted, and to secure such amendments and modifications of existing laws, as might be found necessary for the realisation of the objects in view; fourthly, to take such action as might be found needful to improve the means of communication and transport, and to promote a fuller and freer stream of immigration, both of labourers and settlers into such of the tea districts as most required it. The province of Assam, for instance, with its million of acres of waste land of the most fertile character, and a climate which might be said never to fail in its rainfall, presented in itself a vast and most suitable field for the immigrants, being in fact marked out by nature as one of the most productive grain-growing countries in the world. While fitted in this respect to be a feeder to the rest of India, and a potential factor in warding off famines, and mitigating their effects. The actual rice crops of the province fell far short of the quantity required to feed the large body of labourers and their families located on the tea plantations, thus necessitating a perennial drain from other parts of the empire, and imposing a heavy tax on the employers of labour. Tea culture of India was supported essentially by British capital, and only required a fair field and judicious encouragement, to become the most valuable industry of the country, giving steady and remunerative employment to many thousands of labourers, and aiding materially in sustaining the revenue of the Government adequately to appreciate the value of this boon to India, and the difficulty those engaged in the enterprise had to contend with, and which had been to some extent intensified by legislation, needlessly stringent and costly in its incidence, it might fairly be imputed to the want of sufficient information and the absence of combined representation on the part of those interested.

The Chairman said that he did not intend to detain the meeting with any lengthened observations, because without doubt those present had already acquainted themselves by the help of the very admirably drafted paper which had been circulated, with the objects of the proposed association. When his adhesion to the present scheme had been requested, he had assented with the utmost alacrity, because the promoters of this movement were simply carrying out, in a very proper and efficient manner, the idea that some tea-planters in the north of India had attempted in a rather crude way to put into practice some little while since. (Hear, hear.) During his residence in the Punjab—extending over a period of nearly 30 years—he had taken officially a very great deal of interest, and later, as the owner of some tea-gardens there, a far more substantial and also a more pleasant interest, in the great tea industry of those districts. Hence he had lent all the assistance in his power to the establishment of the association which had been attempted locally, and which had been started in recognition of the very material benefit other industries in India had derived from the formation of associations, and the union of numbers. That movement had, however, failed owing to its inherent weakness and the absence of backbone,—a defect which he was happy to say did not appear to exist in the present scheme. The gentlemen whom he had the honour of addressing were well aware of the work that the very powerful Indigo Planters' Association had performed, and also of the influence which the cotton growers were able to exercise when deemed desirable. The meeting was likewise acquainted with the fact that a great discussion had taken place in India on the question of the cotton duties. At the time when the matter was first mooted, he was a member of the Legislative Council, and in the

deliberations which had taken place on the subject, he had been much struck by the view put forward by the Cotton Growers' Association. It had been urged by the body that as India was in no sense a colony, but rather an integral part of the empire of Great Britain, there should therefore be no difficulties or obstacles put in the way of the free interchange of produce and trade. Having at the time an eye to tea-planting, it had occurred to him that this argument was readily capable of extended application, and he had argued with himself, that if the Manchester trade were so strong as to solicit a repeal of the cotton duties, tea growers might bethink them of a like claim they had, and might plead for the exemption of the duty of 6d. a lb. now levied on all Indian teas brought into England. (Hear, hear.) Now, while he was not at all prepared to advise, or even suggest, any agitation in that direction at the present moment, he did desire to lay special stress on this point, as affording one of the best possible reasons for tea growers forming themselves into an association. (Hear, hear.) However, all such bodies, undoubtedly insignificant in themselves, were to affiliate themselves, to a powerful and centralised association, such as it was proposed to form, numbering among its subscribers and supporters, possibly some members of Parliament and men of high position and political influence, there was every assurance that they would be able to make their wishes known to the Secretary of State for India. If this could be done, a great work would have been achieved, and good and substantial service would have been rendered to many hundreds of their fellow countrymen engaged in one of the most estimable industries in the world. (Hear, hear, and applause.) The Chairman concluded by moving the first resolution as follows:— "That an association be formed on the basis put forward in the printed circular, dated 14th July 1879, and that this association be called the "Indian Tea Districts' Association."

Mr. G. Williamson seconded the resolution, which was put and carried unanimously.

The Chairman next moved, "that all proprietors and planters, and all those interested in the India tea districts, be invited to join the association as annual subscribers."

Colonel Hopkinson seconded the resolution, which was then put and duly carried.

The Chairman then moved, "that the minimum annual subscription shall be one guinea for individuals, and that companies and owners of estates be solicited to subscribe on a larger scale."

Mr. W. Roberts, in seconding the resolution, explained that the subscription had been fixed in the first place as low as one guinea, in order that the association might at once find itself in funds to defray the ordinary expenses incident to its inception. Then it had been deemed advisable to afford the committee an opportunity of soliciting large companies and the owners of estates to contribute to the funds of the association on a larger scale, for it was obvious that if the association were to deal with the subject of the interests of tea growers in an effective and satisfactory manner, the support extended to it should be of a liberal character. (Hear, hear.)

The resolution was then put, and carried unanimously.

The Chairman next proposed "that the undermentioned gentlemen be solicited to become members of the executive committee, with power to add to their number":—Sir T. Douglas Forsyth, K.C.S.I., C.B., late Commissioner of Oude; Colonel Hopkinson, late Commissioner of Assam; Alfred J. Holiday (of Messrs. Lyster & Co., Bradford); Herbert Knowles, Esq. (Director, National Bank of India); Alex. Lawrie, Esq. (Alex. Lawrie & Co., London); Robert Lyall, Esq. (of George Williamson & Co., London); Wm. Maitland, Esq. (a Director of the Assam Tea Company); General T. W. Mercer (retired Bengal Staff Corps); J. A. N. Marten, Esq. (a Director of the Borelli Tea Company); Wm. Roberts, Esq. (Jorehaut and Darjeeling Tea Companies); Dr. Wm. Thompson (Moran Tea Company); Arthur Thompson, Esq. (Messrs. W. J. and H. Thompson); James Warren, Esq. (Dooma Dooma Tea Company); Geo. Williamson & Co., London; J. H. Williamson, Esq. (of Messrs. Williamson, Magor & Co.)

The resolution having been seconded, and carried unanimously, some discussion ensued, in the course of which the following gentlemen were duly nominated as additional members of the Committee, viz., A. B. Fisher, Esq. (a Director of the Assam Tea Company); Herbert Bainbridge, Esq. (a Director of the Land Mortgage Bank of India); Henry Berners, Esq. (Messrs. Berners, Sanderson, and Upton); Samuel Bird, Esq. (Messrs. Bird & Co., Calcutta).

Mr. Sangster desired to know if it were intended that the association should protect the interests of any other product than tea, such, for instance, as cinchona, wheat, hemp, flax, &c. He was inclined to think these products should be included within the programme of the association. The present movement was, in his opinion, only the germ of a very large and powerful association.

Mr. Grindrod called attention to the fact that coffee possessed an association of its own; that product, therefore, was independent of any further assistance. He opposed any extension of the objects of the association beyond those already prescribed.

General Mercer begged to second Mr. Sangster's suggestion. He hoped to see the association grow into a great guild, and he urged the desirability of strengthening their position by the nomination of a greater number of gentlemen as members of the committee, and by the admission of as many Indian products as was practicable. He desired to put before the meeting the advisability of increasing the committee up to 30, and of including among the objects engaging the attention of the association other Indian products than that of tea.

Mr. S. Ward was of opinion that the association should be kept within the lines laid down in the printed circular. It was well to bear in mind that the association was called the Indian Tea Districts' Association. About the time cinchona was grown on tea plantations, he thought that and a few other products of a kindred character might be embraced by the association.

Mr. Holiday also approved of the extension of the objects of the association in the direction indicated by the last speaker. The circular convening the meeting fully recognised the claims of other products on the attention of the association, and allowed of their being admitted to a share of its benefits. (Hear, hear.)

Mr. George Williamson deemed it would be highly injudicious to widen the scope of the association, until time had afforded them an opportunity of testing the success it was possible to attain, in regard to the object they had immediately in view, and which was undoubtedly of paramount importance at the present moment. He had no doubt that later, when the association had shown what it could do, no objection would be raised by any one interested in the movement to the extension of the association, so that it might equally embrace other Indian products. For the present, however, he considered any such attempt inadvisable, and begged to move as an amendment "That the association be limited for the present to the scope and objects laid down in the printed circular."

"Mr. Sangster's proposition—"That the scope of this association be enlarged to include all other Indian products," was then put to the meeting and lost by an overwhelming majority, two or three hands alone being held up in its favour.

Mr. Holiday said the pleasing duty devolved upon him of proposing a vote of thanks to their respected chairman for his able and courteous conduct in the chair that day. (Hear, hear.) In moving this resolution, he desired to urge the necessity of well-concerted and well-sustained co-operation with the association on the part of those interested in the tea industry.

Mr. Robert Lawrie had pleasure in seconding the resolution. The movement initiated that day marked a fresh starting point for Indian merchants. In the course of the next session a special Minister of Commerce would be probably appointed, and it would prove a matter of extreme importance to the trade, that through the medium of this association, they should have direct communication with such an authority. (Hear, hear.)

The resolution was then carried unanimously.

The Chairman briefly acknowledged the compliment, and before the proceedings closed, 66 members were enrolled.

INDIAN CORN AND ITS VARIETIES.

Among the indigenous grains of the American Continent, Indian corn (*Zea mays*) stands pre-eminently high, as regards its value to the human family as an article of food. There are many varieties of wild rice, wild oats, wild rye, and other native cereals that would go far to sustain life, but none of them can take rank with corn or maize in its now almost-numberless varieties. It is this great variety that has caused a doubt with some as to their having originated from anything like a single species.

Doubtless, the mere difference of latitude or length of the growing season or mode of culture, or quality of soil, have an influence in modifying a single species and the production of variations from the original type. Be this as it may, we now have varieties that seem adapted to any phase of climate, from the torrid through the entire of the temperate zones of the earth, in any land and country, though unknown to the rest of the world until the discovery of the American Continent by Europeans.

There have been numerous disputes as to the native country of the maize, some writers wishing to prove that it has an Eastern origin; but it has not been found on any antique sculpture, neither is it mentioned by any o the ancient writers as a cereal grain of Eastern climes. Climate, combined with cultivation, has produced the varieties we now find, and a very singular form of maize is found growing spontaneously in the moist forests of Paraguay. Each seed of this particular corn is wrapped in a chaffy kind of husk, which husk, after two years' cultivation, disappears, and the kernels become bare like ordinary maize.

If any proof was wanting that the ancient inhabitants of the new continent were the growers of corn, we have the evidence both from North and South America. The Smithsonian Institution has an ear of corn, found deposited in an earthern vessel eleven feet under ground, in a grave with a mummy, near Ariquipa, in Peru. The grains are rather sharp-pointed, small, and slightly indented at the apex, lapping one over the other, in thirteen rows. A small portion of this specimen is broken off, hence it is but four and a half inches long. When stationed at Camp Lincoln, Arizona, a surgeon, explored some ancient rock caves near by, which were plastered in the interior, and obtained several corn-cobs, two of which were preserved, and are now in the museum of the Smithsonian Institution.

One is slender and narrow, being five and one-quarter inches long; the other is thicker, but its length is only four and one-half inches. The former had ten and the latter eight rows of grains, with no more difference discernible than exists among the corn raised by all the Pueblo Indians of to-day, and which certainly is the kind grown by them at the Spanish conquest of Mexico. The ruins in which the cobs were found have not been inhabited by the present Indians of the country, who are Apaches, as they believe that evil spirits hover about them, and therefore will not enter them.

Indian corn may be said to be the most universal article of food cultivated by the Indians of New Mexico, Arizona, California, Nevada and Utah, while the tribes of the Indian Territory consider this grain their staff of life. The cultivation of this corn has not been acquired by them from others. It is a matter of historical record that, when living in the Southern States long before the white man had set foot in the country, it was cultivated, and by nearly all the Indians of the present United States to a greater or less extent.

The Indians who grow it in the primitive manner, and have the original corn of America, are the Pueblos of New Mexico and Arizona. The grains vary in colour through shades of pink, blue and white, and the ears

are generally rather small and slender. The blue variety is preferred for bread, and is sorted from the rest with much care, and stored by itself. The cob or ear has fourteen rows of grains, which are full and plump, and is six and three-quarters inches long, and four and three-quarters inches around. The corn, after being reduced to meal in a stone mortar, has a peculiar bluish-white appearance.

Columbus is said to have found the maize in cultivation when he landed at Cuba, and the Pilgrim Fathers on their arrival at Plymouth saw it in full cultivation as a field vegetable, the Indian tribes all raising it for their food. Some of the larger kinds grew very tall. A "tree corn," brought from China to America is of extraordinary height, but the early mandan corn and the Canada corn have exceedingly low stems; the latter matures in a few weeks time. Maize is probably, with the exception of rice, the most extensively—that is, widely, cultivated grain in the world: it extends from the Azores to the most southern part of Europe, being raised to a certain extent even in Asia Minor, Egypt, Hindostan, and China.

From these original growths have come the wonderfully varied and interesting varieties that now furnish so many of mankind as well as countless lower animals, with a most important and coveted article of food.

The hardihood of maize, the facility with which it is propagated, and the extent of the geographical range in which it thrives, have probably contributed to throw obscurity on the history of its introduction into the different countries in which it has been naturalised. In the first volume of Ramusio, published in 1550, there is a very accurate woodcut of an ear of of maize, which is thus described:—"The wonderful and famous seed called maize, of Western India, on which one-half the world is fed. The Portuguese call it 'Maglio Zaberto,' and some of it has already come into Italy, both red and white. Above Polesene de Brigo and Villabona, whole fields of both colours, red and white, are cultivated." From this, it would appear that within little more than half a century after the discovery of America, maize was already an object of extensive cultivation in some parts of Italy.

There are a couple of million farmers in the United States engaged in the raising of maize or Indian corn—spoken of over all English-speaking America, simply as "corn." Some lands produce but 20 bushels to the acre, others 150, swelling the aggregate crop of the country to vast dimensions. The Indian corn-crop there amounts to nearly five hundred million dollars in value, and would suffice to feed not only the population of the United States, but half that of Europe in addition, for a year. England now imports from 19 to 24½ million cwts. yearly, comparatively little of it for human use, though the corn-flours prepared from it are in increasing use. It is chiefly used here as a cattle-food and for starch-making. Its use was almost unknown in the United Kingdom up to the date of the potato-famine in Ireland (1846). There are delicious preparations of it for the table, in America, little known in Europe.

How rare it is to see maize on English tables as a vegetable, and how generally one meets with it in America. Several attempts have been made to introduce it into this country, but the boiled ears have never found much favour in English eyes, still it really is one of the most nutritive of vegetables, and the "wrinkled kernelled sweet corn," as this especial table kind is called in New England, forms a delicious green vegetable. The ears should be cut when the grains are as large as a big marrowfat pea, and the time for boiling is thirty minutes. There is a little amount of practice required before you can pick out the grain with your fork in the orthodox way, but our cousins across the water are not particular on this point; they eat them off the cobs. This maize is somewhat like asparagus in flavour. Green corn should be cooked on the same day it is gathered; in a few hours it loses its sweetness which must be artificially supplied. Strip off the husks, pick out all the silk, and put the corn in boiling water; if not entirely fresh, add a table-spoonful of sugar to the water, but no salt; serve on an open meat dish covered with a napkin; or you may cut it from the cob, put in plenty of butter and a little salt, and serve in a covered vegetable dish. Maize in England should not be sown in the open before May, as our late frosts are apt to injure the crop. Sow in rows the first week in May, allowing fifteen inches from plant to plant. The soil should be rich, and do not forget to water well during the period of growth, July and August. Maize so treated will produce good green corn for table use all through October, long after peas have departed. A full-grown maize plant is really a most ornamental object. It partakes of the style of tropical vegetation, the foliage is large and dark green, the internodes of the stems bright, and the joints prominent and well defined. A number of aërial rootlets, tinted with various colours, project from the lower portions of the stem, and find their way into the surface soil; these serve as cables to support the growing stalks, so it is best not to "hill" Indian corn, that is, draw the earth up into conical mounds—as some English amateur growers advise, round the stems. The white-gourd seed corn is the one in used for "hominy" and cakes. Corn cakes are a standing dish in America, and very good they are. The sort of maize known as the "Tuscarora" is often planted to furnish the table with green cobs, but it is not so fine as the wrinkled kernelled, though there is considerably more starch in it than in the latter. The rice, or "pop corn," abounds in starch; red corn is simply a variety of the "King Philip" sort, which is so highly esteemed in New England.

Damas in his *Memories de Chimie*, p. 365, observes: "Considered in its economic value, maize, according to its composition, stands in the first rank of cereals, in fact, besides its proportion of nitrogenous matter, which is nearly equal to that contained in any other grain, the pleasant and edible oil which it contains in so large a proportion, adds to its other alimentary properties. In short, very few of the productions of nature contain like maize all the principles necessary for the nutrition of men and animals.

M. Payen, with but a slight difference, expresses himself nearly to the same effect. The advocacy of the more extended use of maize as human food has recently been brought before the Paris Société d'Encouragement in a learned paper by M. Fris of Padua, in which he enters fully upon the hygienic and economic advantages of maize for food, and recommends its extended culture in the North of France. He passes under review a long list of authors of the 16th and 17th centuries, who mention the important part this grain plays in the food sustenance of the early inhabitants of the new continent,—Father Labat, the missionary; F. Hernandez, surgeon to Philip II. king of Spain; Garcilasso de la Vega and Jean de Laet, historians of the New World. He then traces it down to the eminent men who eulogise it in the 19th century, at the head of whom stands Parmentier. He gives extracts from the celebrated treatise on maize of the illustrious agriculturist of Montdidier, which was rewarded by the Academy of Bourdeaux.

F. de Neufchateau wrote a supplement to the celebrated memoir of Parmentier, on the culture of maize. Lelier, Rumford, Duchesne, Bonafous Cobbet, and many other writers on maize are quoted by M. Fris. The writer disputes the arguments of M. Bext Pecot, who recommends in grinding maize the removal of certain portions, such as the city and resinous matters which give an unpleasant taste to the flour. On the contrary, he advocates the use of the whole meal without any separation. Still he considers a mixture of half maize and half wheat flour useful for making bread, such as is purchased in many towns of Italy, especially Turin and Milan, which furnishes a healthy and economic food for the working classes.

According to M. Lelieur, director of farms and royal parks, Louis XVIII. was very fond of maize bread. Washington also ate it constantly.

M. Fris expresses his astonishment that maize is not more utilised in the hospitals and other public establishments supported by the State. If the Public Assistance establishments were more enlightened on the nutritive qualities of maize, they could introduce this economic food with great advantage. A report on the subject was very recently submitted to the Academy of Medicine by Professor Eubler.

The maize plant is affected in a remarkable degree by climate and soil; but it soon adapts itself to a locality, and by continuous cultivation from the same seed, year after year, a local variety or strain becomes established. Though all the kinds of maize in cultivation, at least in the United States, are regarded as of one species, the varieties are almost endless. These are produced not only by local influences but by selection. It is one of the species in which any peculiarity may be readily fixed in a few years by carefully selecting and sowing seeds from those plants which have the desirable features most strongly marked.

In respect to size, there are varieties from two or three feet high up to fifteen and eighteen feet, with the stalks and leaves large in proportion. The ears vary very greatly in size and number of rows of kernels, which sometimes reach twenty-four, thirty-two, or more. The grain presents a great variety in colour, from white through various shades of yellow or orange, red brown, violet, purple, and black. By the crossing of varieties, kernels of two or more colours in stripes and blotches are produced. In the Tuscarora and some others the grain is dull and opaque, while in the so-called "flint" varieties, the mass of the grain, the albumen is translucent: the opaque kinds are very starchy, while the others contain large proportions of fatty matter. In the varieties known as "sweet corn" the grain is very much wrinkled and shrivelled: in these the conversion of sugar into starch is arrested, and the kernel does not fill out.

Indian corn may be regarded as a universal crop in the States, raised to a greater or less extent on every farm. It is extensively used as a bread material, and as such it is nutritious, healthful and quite palatable when the habit of its use is acquired. In the form of hominy it has to a great extent displaced rice, being more nutritious and palatable. Corn is essentially the food grain of stock in the States. Cattle, horses and hogs are fed on it, either in the grain or ground, and mixed in various forms. Indian corn furnishes a large amount of forage, equal in nutritive qualities to ordinary hay, and relished fully as well, especially by cattle. This grain requires a deep rich loam, well pulverized and relieved of surplus water. After the ground is thus prepared, the grain is planted in "hills," so as to form straight lines in two directions, from three-and-a-half to four feet apart, and three or four stalks are cultivated in each hill. This planting is usually done by horse power, with an ingenious implement which drops the seed and covers it at the same *operation*. *Sometimes the seed is* planted in drills from *four* to *four-and-a-half* feet apart, planting a grain at intervals of ten or twelve inches in the row. This is also performed by appropriate machiney worked by horses.

The corn crop is planted in the month of May; in the southern counties a little earlier; but as corn requires a temperature of about 60° F. to produce germination, very early planting is hazardous. After the young corn has appeared, the cultivation commences, and about once a week for four or five weeks, the spaces between the rows are thoroughly stirred with the cultivator, or small plough. After this the growth is very rapid, and by the 1st of August the stalks have attained their full height, and the ears are formed. On good soil, well cultivated, corn stalks attain a height of from ten to fifteen feet in Indiana, and the crop is expected to yield from thirty to eighty bushels of grain (fifty-eight pounds per bushel) per acre. If it fall below the minimum figure, the crop is regarded as a partial failure

and (if it exceed the maximum, it is considered an extra crop. Corn planted in May ripens in that latitude in September, but if the growth be healthy, the luxuriant foliage of the corn plant will yet be green, while the grain is quite hard. In this condition the crop may be cut and set up in shocks to cure. The grain will suffer little or nothing if the cutting be not done too early, and a large amount of excellent forage be thus secured. But farmers seldom avail themselves of this resource, except when the hay crop fails. Usually the crop remains in the field till November, when the ears alone are gathered, and put into open bins or cribs to dry. After a few weeks the corn is ready for the market, that portion of the crop, however, which is used for fattening pork and beef for the winter market is usually fed directly from the field, being gathered from day to day as it is needed. No systematic method of manuring has as yet been adopted in corn culture in the States. The virgin soil, rich in both mineral and organic elements of plant food, does not seem to need manure; but the time is near when this matter will demand attention. Indian corn is a gross feeder and a vigorous grower, and cannot long be cultivated on any soil without exhaustion.

The total production of maize in the United States in the Calendar year 1877 was 1,342,558,000 bushels. The average weight of the bushel is 56lbs. The total area on which the crop was grown was 50,369,113 acres. The total value of the crop (averaged at 35·8 cents the bushel) 480,643,400 dollars. The average value of the yield per acre 9 dollars 54 cents. The consumption is in the proportion of 26 bushels per head of the population, but it is chiefly fed to live stock. The quantity consumed was 1,257,110,825 bushels, and the quantity exported in 1878, 85,461,098 bushels, besides 432,753 barrels of corn meal.

The quantity of maize exported in the form of grain and of corn meal is much less than the quantity consumed by animals, constituting the exports of live animals and provisions. A considerable quantity of Indian corn also enters into the American exports of spirits.

During the ten years from 1850 to 1859, inclusive, the average annual exports of corn and corn meal from the United States amounted to 6,453,775 bushels; during the ten years from 1860 to 1869, inclusive, the annual average quantity exported amounted to 11,284,085 bushels; and during the nine years from 1870 to 1878, inclusive, the annual average quantity exported amounted to 40,606,838 bushels.

It is estimated that the acreage devoted to the production of Indian corn in the United States increased above 80 per cent. from 1870 to 1877, while the increase of production is estimated to have been about 20 per cent.

The rapid extension of Indian corn culture in the States has increased the pork supply very much beyond the requirements of home consumption, leaving a yearly increasing surplus for export to foreign countries. The falling off in the price of corn seems to have corresponded nearly with that of pork and pork products; the export price of the former having fallen from 93 cents per bushel in 1870 to 56·2 cents in 1878.

WATTLE FARMING.

THE cultivation of the wattle (*Acacia sp.*) for commercial purposes has till now remained an undeveloped industry. Although a remunerative undertaking, no attention has been paid to its cultivation, and consequently a direct source of wealth has been neglected throughout this colony (South Australia).

Since the first utilisation of the wattle here, the operations of the stripper have been under no regulations or restrictions of any kind, and the result has been disastrous to its growth. Lately, however, regulations in regard to wattle stripping on government land have been issued.

Wattle farming will be an industrial branch of great importance, and if the tree is systematically cultivated, it will be beyond doubt a profitable speculation.

In my lecture read recently before the Chamber of Manufactures on "Forest Tree Planting," I have already called attention to this useful tree.

The Board of Enquiry appointed by the Victorian Government to deal with the wattle bark question in Victoria, has issued its report, a document of great value, as particular care was taken by the Board to elicit a general expression of opinion on the subject, and numbers of witnesses from all parts of Victoria were examined.

In perusing this important report, I was surprised at the immense consumption of wattle bark. The quantity required for consumption in Victoria only is from 12,000 to 15,000 tons per annum, exclusive of the large quantity exported to England where higher prices are offered. The current price for good bark is, in Melbourne, from £5 to £5 12s. 6d. per ton, making £63,000 to £78,750 per annum. I am unacquainted with the annual consumption and export of wattle bark in South Australia, but it is also undoubtedly large.

The numerous witnesses called before the Board of Enquiry in Victoria agree in one point, viz. :—That a lesser quantity of bark is obtained from year to year as the wattle is disappearing; whole districts are already denuded of it, and unless some steps are taken to encourage the growth of the wattle trees, the end will be the total extermination of this useful native production. At no distant time the same fate would have awaited the wattle of South Australia, had not the government issued regulations which restrict the stripper as regards the size of the tree to be stripped. In South Australia, with the exception of the South-east, the broad-leaved wattle, *Acacia pycnantha* (Benth.), is only used, but in Victoria there appear two more kinds, viz.,—the black wattle, *Acacia decurrens* (Willd.), and the silver wattle, *Acacia dealbata* (Link). Amongst these three kinds the bark of the broad-leaved wattle is considered the most valuable, containing the greatest quantity of tannin, that of the silver-wattle is not so valuable, being deficient in tannin. The black wattle is considered the most productive species; it is one of the quickest growing Acacias, reaching in a course of ten to twelve years a height of from 30 to 40 feet. It can be barked at eight years of age, and will produce 40lbs. to 60lbs. dried bark, and full-grown trees will yield 100lbs. to 150lbs. per tree. The black wattle thrives with us most luxuriantly. Trees in the Botanic garden ten to twelve years old have reached the height of 40 to 50 feet. The South Australian broad-leaved wattle is a much smaller tree, and the return not so payable as that from the black-leaved wattle, therefore I recommend the latter for planting.

As already mentioned, the cultivation of the wattle for commercial purposes has till now remained an undeveloped industry; but no doubt as soon as it is understood, the utilisation of many acres of private land, at present lying waste for miles north, south, and south-east of Adelaide, or which has already been exhausted and rendered unfit for the growth of cereals, will be effected by the cultivation of the wattle, as it grows readily in almost any soil, and requires so little attention as to make its general cultivation very profitable. Another important point is that wattle-growing and grazing can be combined satisfactorily. After the first year when the young trees in the plantation have reached the height of 3 to 4 feet, sheep can be turned into the plantation without injury to the young trees.

We hear that the supply of tanning bark, like the material for making paper, becomes scarce in England, and that English tanners depend a good deal on Spain and other Continental countries for their supply of oak-bark; therefore, England will always be a consumer of our surplus wattle-bark, and I think that the market will not often be so glutted as to effect the price of the bark much.

Wattle cultivation will no doubt attract considerable attention from many persons who may be without the information necessary to enable them to engage in its systematical cultivation. According to the report of the Wattle Commission, wattles grow in almost any soil, even the poorest, but their growth is most rapid on loose sandy patches, or where the surface has been broken for agricultural purposes. When the soil is hard and firm it is recommended that plough furrows should be made at a regular distance of say six or eight feet apart, into which the seed are to be dropped. The seed should be sown in May, having been previously soaked in hot water, a little less than of boiling temperature, in which they may be allowed to remain for a few hours. The seed should be dropped at an average distance of one foot apart along the furrow, in which case about 7,200 seed would suffice for one acre of land. The seed should not be covered with more than one quarter of an inch of soil.

On loose sandy soil it might even be unnecessary to break up the soil in any way. On such open sandy soil the furrows may be dispensed with, and the seed sown broadcast, and after the land is harrowed. After the plants have come up they should be thinned so that they stand six to eight feet apart from each other. When the young wattle trees have attained the height of three or four feet, the lower branches should be pruned off, and every effort afterwards made to keep the stem straight and clear, in order to facilitate the stripping and induce an increase of yield of the bark. It is advisable that the two kinds of wattle, *viz.*, the black and broad-leaved, should be grown separately, as the black wattle being of a much larger and quicker growth would oppress the slower growing broad-leaved one.

If attention is paid to the cultivation of the wattle as a source of income, care should be taken to replace every tree stripped by re-sowing, in order that there should be as little variation in the yield as possible.

The months of September, October, November, and December, at least in Victoria, are the months in which the sap rises without intermission, and the bark is charged with tannin.

In the report it is also said that the character of the soil appears to affect to some extent the quantity of the bark obtained. A careful analysis also proved that the bark from trees growing on limestone formation, was greatly inferior in tannin to that bark obtained from another formation, differing from 10 to 25 per cent. tannin.

In order to more fully elucidate the scheme of wattle cultivation proposed to be carried out, the following tabulated statement is given in the report of the Wattle Commission :—

Estimate of Expenditure on a Wattle Bark Plantation of 100 acres during eight years.

	£	s.	d.
Rent of 100 acres for eight years at a rate of 6s. per acre per annum	240	0	0
Ploughing 100 acres in drills 10 ft. apart ...	25	0	0
Sowing wattles and actual cultivation, including cost of seed	37	10	0
Supervision for eight years (nominal), say £10 per annum	80	0	0
Pruning the trees, taking off useless wood (only necessary for two years), 10s. per annum ...	50	0	0
Incidental and unforeseen expenses... ...	27	10	0
Interest on the whole amount expended during eight years	240	0	0
	700	0	0
Actual cost of stripping and carting, as shown below	1,515	0	0
	£2,215	0	0

Receipts derivable from a Wattle Plantation of, say, 100 acres planted in the manner proposed.

	£	s.	d.
Each acre planted with wattles, 10 ft. apart, would carry 400 trees, and at end of fifth year, trees would yield say 56 lbs. matured bark. Stripping only every third tree, 332 trees would be obtained off 100 acres. This, at £4 per ton, would give for first stripping	1,332	0	0
In the sixth or following year a similar number of trees would be stripped. The bark having increased in weight (say 14lbs.), the increased yield of second stripping would therefore be 400 tons at £4 per ton ...	1,600	0	0
In the seventh year the remaining trees would be stripped, from which a still greater increase would be obtained, say 480 tons at £4 per ton	1,920	0	0
Total yield of bark would therefore represent a money value of	£4,852	0	0
The cost of stripping would not exceed 15s. per ton, on account of the facilities presented by the regularity of the trees, while carting would represent another 10s. per ton. These combined charges would be 25s. per ton, and on 1,212 tons would be £1,515, leaving a clear profit on the 100 acres (after allowing for the primary expenditure) of ...	£2,637	0	0

—*Richard Schomburgk, Dr. Ph., Adelaide.*

TEA CULTURE.

(*The Cincinnati Commercial, February 20.*)

EXPERIMENTS WITH PLANTS IN AMERICAN SOIL.

PROMISE OF BETTER TEAS THAN THE CHINESE PRODUCE.

OPENING OF A NEW INDUSTRY TO AMERICAN ENTERPRISE.

BALTIMORE, February 19.—The culture of tea in this country, which has attracted public attention during the past year, has received a fresh impetus from the visit of a member of the firm of Messrs. Martin Gillet & Co., of this city, to the South, at the request of the Department of Agriculture, at Washington, the visit being one of inspection, and to gather data that would enable him to arrive at some intelligent conclusions concerning the practicability of the project, and as the enterprise is so closely identified with Baltimore, by the efforts of this firm, who are the pioneers of the industry in our country, an account of what has been accomplished, and what the future promises, may be of interest to the general public.

We are now paying China and Japan over $20,000,000 annually for tea, and if this large sum can be diverted to our own land, it will be a double gain, and largely assist in giving prosperity and employment to our Southern people. With this view, your correspondent has sought out the facts as they now exist, which he now lays before your readers. However successful the growth of the tea plant (*thea viridis*) may be in our country, it is useless unless the leaves can be more cheaply manufactured into tea, than the same can be imported from China, and the question resolves itself into two propositions.

First.—Will the tea plant grow and produce luxuriant leaves with our climate and soil?

Second.—Can the leaves be manipulated into a merchantable article of tea that will successfully compete with the productions of China and Japan?

In reply to the first it may be well to give a history of the introduction of the plant into America—which, bear in mind, is quite apart from the production of the tea of commerce. It don't "grow on de cob," as the darkey thought. Attempts have been often made to bring the tea seeds from China, but for a long time it was found that with the greatest care in the transportation, the seeds would not germinate, and the only reasons assigned were that either the long voyage destroyed the vitality, or that (which was the most probable) the seeds were *boiled* in China by the shrewd natives, who were jealous of a rival. In 1860 some good seeds were successfully germinated in the Government nursery at Washington, and just before the war the young plants were distributed by the Patent Office throughout the States of North Carolina, South Carolina and Georgia. No special directions were sent with these plants. Those that received them regarded them as curiosities, and they were mostly planted in gardens. The war coming on, the tea plants were forgotten, left to take care of themselves, yet notwithstanding the vicissitudes of the circumstances, those that escaped the ravages of the pigs (for it is a singular fact that pigs regard the tea-leaf as a *bonbouche*) thrived, and are now large plants, of four to six feet high—covered with bloom in the fall and winter, and prized as a highly ornamental shrub, living examples of the great hardihood of the plant.

The general impression is that the tea plant is a very delicate one, requiring a tropical climate, but this not the case, and a good freezing is more beneficial than otherwise. Messrs. Martin Gillet & Co., in order to see how hardy the plant was, tried various experiments this winter. They took seedlings from a hot-house (a severe test) and planted them in various situations in Baltimore, some protected, some exposed. Every one knows the severity of this winter, yet, on uncovering a lot of plants last week that had been planted against a fence, and covered simply with a few dried leaves, they were found in fine condition. By a careful acclimatization these gentlemen have no doubt the plant will stand our winters, and certainly those of Virginia.

Regarding the successful growth of the plant there can be no question, and Mr. Gillet, who visited the South, and who has lived many years in China and Japan, says he never saw finer plants anywhere than he saw in Georgia and South Carolina.

The next question was, Will these leaves produce as good a tea as those of China? An unsolved problem, till Messrs. M. Gillet and Co. procured from Georgetown, S.C., last spring, a box of fresh leaves from these same plants, and they could only get about ten pounds, but it was quite sufficient for the experiment. These were manipulated into tea in this city, and the result was a product that in the opinion of experts was equal, if not superior, to any we get from China or Japan. One great advantage it had over them was its freshness, which is a great item in the quality of tea, for, like similar articles, freshness is a great recommendation. In commerce a new tea will bring from ten to thirty cents per pound more than an old one. While speaking of new China teas, it is only a comparative expression, for they are generally six months old before we get them, whereas an American tea could be had only six days old. And this being the case, one can readily see what a great advantage a tea produced in our own land would have over those from so remote a country as China.

The successful growth of a leaf capable of being transformed into a tea of the finest quality being demonstrated, the only remaining question is, Can tea be manufactured out of the green leaves at a cost that will insure profit? This is the only doubt that can be cast on the subject, and as yet it is an unsolved one, to be left to the future; but Messrs. Martin Gillet & Co. feel quite confident that they can point out the road to a successful solution of this only doubtful point.

The American people little suspect that the teas they use are manufactured solely for export, and are not known to the Chinamen. A striking illustration is given of this by a member of the Chinese Legation on his visit to Baltimore last week. At an entertainment, he was asked by the hostess: Mr.——, what is the best kind of tea: we always use the finest *Gunpowder*." "What, Madame?" "Gunpowder," replied the lady. "I never heard of it in China," and in a subsequent explanation he said he supposed those were the teas made for the foreigners, because they liked pretty teas.

In another interview, held at Washington, with the Legation, it was stated that one-third of the cost of green tea was in rolling, polishing, coloring and fancy twisting, necessary to give them that appearance which is regarded as a criterion of merit by the American consumers.

Messrs. Martin Gillet & Co. insist that the old idea that in order to make good tea, the intricate methods of the Chinese must be followed, is a false one, and in their experiments they have eliminated every useless manipulation (designed to improve the looks solely) from the process, and claim to have produced an American tea on American principles that will rival in quality and price that of China.

We have here two striking precedents in tea culture that will illustrate our chances of success in America. Many years ago Brazil attempted to produce tea; they grew the plants to perfection, but not knowing how to make the leaves into tea, they imported Chinese labour, and went to work to produce Chinese tea in form, shape, and colour. That seemed the principal object to make a tea that could be sold for China tea. The result was a signal failure, and we hear no more of Brazil tea.

In India, on the contrary, the English have, by the introduction of the machinery and by scientific methods, raised the quality of the India tea to a point that it is crowding out that of the Chinese tea in England. I am permitted to make the following extracts from an interesting letter, written by a most intelligent manager of a tea garden in India to Messrs. Martin Gillet and Co.

Here is something practicable, and from which some deductions of the possibilities of the successful manufacture of tea in our country can be formed. The American public has been deluded into the idea that form and appearance were essential elements of good tea, and the old lady who would drink nothing but Gunpowder tea, little imagined that it was called so because it went through a small sieve and yet grew on the same bush, was cured in the same pans, and was packed in the chest by the same naked pair of feet as the despised Imperial or Young Hyson.

So it is that Messrs. Martin Gillet & Co., ignoring the foolish prejudices of the people, think they have discovered a solution of the tea question, by simplification and machinery. Of course, tea men ridicule the idea, and cry out that these gentlemen, if they succeed, will ruin the trade, but they take a bolder view of the question and have but one reply, which is, "What is best for the people is best for us." No one has given the same study to the science of tea making as these gentlemen, which their many visits to China and Japan have enabled them to perfect.

The principal object of their recent visit to the South was to find out where good leaves in sufficient quantities could be found, so that when the proper time comes, they can secure the leaves and practically demonstrate the value of the product by making the tea and testing its quality. They think they will have quite a lot of leaves in April, for they have offered a large price for the fresh leaves, and given minute directions as to the plucking and forwarding by express to Baltimore. Their experiments will be looked forward to with much interest.

In conclusion, these gentlemen say that only organized efforts, backed up with capital, and proper mechanical appliances, will prove successful in the South. A few desultory efforts here and there, while it may produce tea for the uses of the household, will not, in their opinion, produce results commensurate with the great importance of the enterprise to our people.

[The above interesting article is from the *Cincinnati Commercial* sent to us by a planter, to whom our thanks are due. There can be little or no doubt that the tea plant will flourish in the Southern States, and probably the flavour of the leaf may be good. The question

will be one of labour, for no labour-saving appliances can dispense with human hands, at least for plucking. On this ground alone, therefore, we suspect it will be found cheaper to import teas from Asiatic countries which have labour plentiful and at less cost than in the United States. Special strength will be added to this argument if Chinese immigration is really stopped. A further question as to the frequency of "flushes" on the tea plant in America arises.—Ed. *C.O.*] —*Ceylon Observer.*

A PLEA FOR TREES.

A CORRESPONDENT writes :—"In a country like India the questions of forest conservancy and deforestment are more than interesting ; they are of vital importance. To any one travelling over Southern or Central India, the vast treeless plains are a well-known feature. The arid red or black soil, with perhaps a bright green spot here and there where an enterprising ryot has dug a well, surrounds one from horizon to horizon. And this is the character of the "scenery" for miles and miles, save where a silver streak with fringe of greenery, marks the course of some river. Overhead the relentless sky with glaring sun, and quivering hot air near the parched soil. But trees are not ; no pleasant shade, no relief for the wearied eye is there. The ultimate wealth of a country is its soil. The utter uncertainty of the wretched ryot as to whether his seed will grow, or even growing come to maturity, seems enough to stop all cultivation of that soil, and so to impoverish the country. Yet men are hopeful ; and still obey the old words : "In the morning sow the seed, and in the evening withhold not thy hand," and how often in this country they both shall be alike bad. How long is it to go on ? The Government seem to expend all their ingenuity on discovering the best mode of collecting the revenue—when none is left to collect, they may think the revenue itself to be of more importance than even the collecting of it. "The life is more than meat," is it not ? Reforestment is of importance in so far as it affects the revenue.

"Deserts are treeless, yet even in a desert where a spring of water occurs, trees grow. Given water then, trees will grow, even in a desert ; and that which causes a desert is not lack of trees, but lack of moisture. Is there then no moisture, that India's plains should be treeless ? But, says the revenue official, allowing that trees will grow, what then ? Then trees will do their duty, which is what ignorance can never do. The duty of a tree is at least to live and grow, fix the carbon of our atmosphere, and exhale moisture. The latter fact gives to reforestment its importance, so we may consider a tree an animated pump, drawing water from the soil, and giving it to the surrounding atmosphere. This drains the soil, or that portion of it to which the roots have access, in the case of crops growing in the top soil ; but with trees the case is different, they derive their moisture from the subsoil, which even in the dryest weather has abundance to support them. Moreover the drier the surface soil gets, the greater is the tendency of this deeper water to rise to the surface to supply evaporation. While the atmosphere holds moisture, the soil, especially if cultivated, absorbs water. In wet weather, or when the atmosphere is quite saturated with moisture, the trees cannot exhale their moisture into the atmosphere, but the moisture sinks through the soil, or runs off over it. It is only in the day time or dry weather that trees exhale water vapour ; in other words, only when it is required. As to the absolute amount of water vapour exhaled, it can only be estimated where a forest is concerned, but in the dry plains it must be enormous, since it has been determined that a single grass plant exhaled its own weight of water on a hot summer's day in England. A tree may then be considered as a natural pump raising the water of the lower soil to give it to the atmosphere. In fact, a country covered with trees may be compared to a country covered with *picotahs*, working unceasingly in wells which they find for themselves.

"The exhalation of water from a mass of trees into the atmosphere cools the latter, to say nothing of the cooling effect of the chemical change going on in every leaf, and the difference is quite sensible without a thermometer. This cold stratum of air may have the effect, should a vapour-laden current of air blow over it, of condensing the vapour to rain. But should this happen or not, the moisture given to the air by a forest, condenses partly on those surfaces which cool rapidly after sunset, in the form of dew. When the loss of water by exhalation exceeds the amount that the soil can supply, the tree withers and dies. But did the trees wither and die during the famine, though the crops failed on the surface soil ? Should a tree thus wither and die, it even then contains far more water than the soil, for air-dried vegetation averages from 13 to 15 per cent. of water, while air-dried soil holds but from 1 to 2 per cent. A forest may then, merely regarding its wood, be compared to a sponge covering the ground. So, a tree may be compared to a self-acting pump finding its own water, and giving it to the atmosphere ; and as a pump in action is a column of water, so is a tree a column of water. At the same time a mass of trees keeps the country moist as a saturated sponge would do ; and this sponge is squeezed only when required by the dried atmosphere. To cool the atmosphere and supply to some extent in dry weather with moisture brought from the lower soil, is not this something in India ? If cutting down the olive trees in Provence in 1822 has affected the district, what may we expect in these latitudes from reforestment ? Consider, O revenue official, the revenue may be increased and more of thy class required to collect it ! The climate also may be made moister and some fire-wood may be procurable. Then, too, perhaps some of the manure, which is now used, for fuel, would be applied to the fields, in place of such a gruesome top-dressing of bones, as Famine gives us."—*Madras Mail.*

CONTINENTAL AGRICULTURE.

(*Madras Mail.*)

RESPECTING the important display of fertilising matters at the Exhibition, what most struck the visitor was the absence of all show to attract clients. Manufactures remained content to demonstrate that the preparation of artificial manures was not behind any chemical or mechanical industry, that the raw materials of these manures were sought for with intelligence: transformed and combined in a rational manner, with no secrets to conceal, and sold at prices proportioned to intrinsic value. The proofs were conclusive of the great development in the extraction in France of mineral fossils ; in Belgium of the refinement of chalk phosphates, of the general preference for dissolved and pulverised guano in place of that fertilised in its crude state.

Serious progress was shown to have been made in the torrefaction of animal refuse. However, the treatment of night soil, and its rational utilisation, leaves very much to be desired. It cannot but have also struck the observers how much commerce stood in need of a common chemical language, for the various preparations which restore to the soil, azote, phosphoric acid, and potash—the three terms in use on the continent to express the value of a fertiliser, while in England, ammonia, phosphates, and the salts of potash, are the expressions employed.

It is only since 1840, when Liebig laid down the imperious law of restitution, that a veritable revolution ensued in the trade and manufacture of commercial manure. In France alone three milliards of francs represent the annual sum employed in the fabrication, &c., of fertilizers. France is also the richest country in the world in fossil phosphate of lime, that employed in agriculture being chiefly derived from the tertiary formation in the form of phosphorite and as nodules, in the secondary strata ; the latter are found in the neighbourhood of Lille, Mans, and in the departments of the Meuse, and Ardennes ; the former are chiefly obtained in Aveyron, the Lot, Herault, Tarn and Garonne, Béziers, &c. One firm, Desailly, commenced in 1850 to extract nodules in the Ardennes ; since then, its operations have extended to other parts of France, so that at present it employs 1,000 workmen and produces 20,000 tons of phosphate of lime yearly, of which one third is exported. Some of the phosphates contain from 28 to 33 per cent. of phosphoric acid, and are largely employed in the preparation of superphosphates. The value of the mineral phosphates depends on their mechanical fineness, or pulverisation ; for the assimilation of a fertilizing matter is more rapid, as the points of contact are more numerous with the dissolving agents of the soil—water, carbonic acid, and organic matter. But there is a limit to the economic action of minerals in the shape of impalpable powder, thus a ton of triturated feldspar rock, containing 10 per cent. of potash and costing francs 66, will be infinitely inferior to the salt easily obtainable in a cheaper and more concentrated state.

No doubt it is very laudable to extract phosphates from the bowels of the earth ; to import guano from South America and Australia ; nitrate of soda from Chili, and fish guano from Scandinavia. Not less important is the economic utilisation of the *detritus* of slaughter-houses and knackers' yards, and of public markets. In Paris, cesspool matters afford annually 7,000 tons of *poudrette*, and 8,000 tons of ammonical salts. At Amiens, fecal matters have charcoal for the base of its *poudrette*, and the chopped refuse of flax and hemp. Velvet clippings, brewers' refuse, straw, wool and leather waste ; this mixture, when enriched with assimilative phosphates, sells well. For years the *debris* of slaughter-houses have been in much request in France. But industry entered the lists, and by its aid the utilisation of blood, flesh, horns, hoofs, hair, skins, &c., has become a speciality in France. The firm Burgeois, for example, contracts for the blood of the chief slaughter-houses in this country, amounting to 13 millions of quarts annually, and they employ 260 persons to work it up into marketable products. The blood is dried by three processes ; contains 13 per cent of nitrogen, and is mixed with superphosphates in various proportions. Another Company farms the intestines, &c., of the killed beasts, and when manipulated, this *detritus* is sold in three classes. The average number of animals daily killed in the city *abattoirs* is, 700 oxen, 150 cows, 30 bulls, 400 calves, 6,000 sheep, and 500 pigs. But as horns, hoofs, hair, skins, leather, &c., require two or three years to decompose in the soil, their reduction to a pulverable form is indispensible—hence torrefaction is resorted to. The preparation of bones has many various methods of application, but none particularly new. On the west coast of France, sardine and mackerel refuse, with sea plants, are boiled, after being previously drained, in large boilers; then pressed into cakes while hot, and ultimately dried, and ground. The peculiarity about guano consists in its now being rarely employed otherwise than in a dissolved state, thus permitting of a fixed rate of nitrogen, 12 per cent. generally to be attained ; of late years, much of the Peruvian guano imported had not more than 2 or 3 per cent. of azote, and the farmer was invited to pay a uniform price all the same by the Peruvain Government. France does not manufacture either dissolved or pulverised guano, but supplies her demands from England and Germany. Farmers habituated to employ only farm-yard manure, guano, &c., viewed with suspicion the use of chemical manures ; the honor of destroying their prejudices under this head, is due to M. Georges Ville, only he rode his hobby to death by prescribing doses of chemical fertilisers, compounded on the data of the ashes of cultivated plants, to restitute the salts carried away, just as if we were certain of the conditions of a soil's fertility. Strange, not a manufacturer prepares artificial manures for the general market on M. Ville's principles. It was only in 1860 that Norway commenced to utilise the refuse of her herring, cod, and mackerel fisheries, &c., having by

pressure and steam, succeeded in depriving the refuse of the oil and glue, which proved insurmountable obstacles to the dissolution in the soil of the phosphates and azotised matters. Fish guano is now prepared along sea-coasts in every part of the world; on an average it contains six to seven per cent of organic nitrogen, rendering in this form the action of the manure more slow, certain, and generally useful, and 25 per cent. of phosphoric acid, but not in a state immediately soluble; hence the difference between it and ordinary guano, and the practical lesson, that it ought not to be employed as a top dresser, but harrowed into the soil, before the sowings.

At last we appear to have something definite about the phylloxera, thanks to the International Committee, named at the Trocadéro Congress, and presided over by M. Vimont. The Committee consisted of 25 members, six of whom were distinguished foreign vineyard proprietors; they have examined the question from the first appearance of the malady in 1869, in the department of the Hérault, down to the present moment; they noted the chief cures attempted—three thousand were sent to the Minister of Agriculture to claim the Governmental reward—and visited the suffering and the ruined vineyards. The report states the phylloxera was imported to Europe from America, and the disease can be propagated by artificial—transporting of plants—as well as by natural means—the wind chiefly. Stocks of American vines, as first revealed by M. Laliman of Bordeaux, can resist the bug, they flourish vigorously when the native vines die; the grafting does not in the least alter the delicate bouquet of the French grape; but all American stocks are not equally resisting, the Solonis, Clinton Viallalia, or Franklin and Taylor being the best. The plant when attacked at the root dies from inanition; hence, any insect destroyer must be succeeded by good manuring to give strength to the wounded plant; after farm yard manure, the next best fertiliser is dried blood, with sulphates of potash and iron and superphosphates. The only efficacious insecticide is sulphuret of carbon, as first employed, on the appearance of the disease, by Baron Thenard, and abandoned owing to its severe effects. The manner of employing this remedy is now better understood: two injection holes per square yard suffice to inundate the soil to the depth of 11 inches with the poisonous vapors, and some apply the quantity in 3 doses, at intervals of 4, 6, and 10 days. Submersing the vines drowns the bugs, but the flooding ought only to take place in autumn after all vegetation has ceased. Then the vines can support 11 inches of water, from 30 to 50 days, to be followed in spring by liberal manuring.

THE PASTORAL BEES.

THE honey bees goes forth from his hive in spring like the dove from Noah's ark, and it is not till after many days that she brings back the olive leaf, which in this case is a pellet of golden pollen upon each hip, usually obtained from the alder or swamp willow. In a country where maple sugar is made, the bees get their first taste of sweet from the sap as it flows from the spiles, or as it dries and is condensed upon the sides of the buckets. They will, sometimes, in their eagerness, come about the boiling place and be overwhelmed by the steam and the smoke. But in the spring, bees appear to be more eager for bread than for honey; their supply of this article, perhaps, does not keep as well as their stores of the latter; hence fresh bread, in the shape of new pollen, is diligently sought for. My bees get their first supplies from the catkins of the willows. How quickly they find them out! If but one catkin opens anywhere within range, a bee is on hand that very hour to rifle it, and it is a most pleasing experience to stand near the hive some mild April day and see them come pouring in with their little baskets packed with this first fruitage of the spring. They will have new bread now; they have been to mill in good earnest; see their dusty coats, and the golden grist they bring home with them.

When a bee brings pollen into the hive he advances to the cell in which it is to be deposited and kicks it off as one might his overalls or rubber boots, making one foot help the other; then he walks off without ever looking behind him; another bee, one of the indoor hands, comes along and rams it down with his head and packs it into the cell as the dairymaid packs butter into a firkin.

The first spring wild-flowers, whose shy faces among the dry leaves and rocks are so welcome, yield no honey. The anemone, the hepatica, the bloodroot, the arbutus, the numerous violets, the spring beauty, the corydalis, &c., woo all lovers of nature, but do not woo the honey-loving bee. It requires more sun and warmth to develop the saccharine element, and the beauty of these pale striplings of the woods and groves is their sole and sufficient excuse for being. The arbutus, lying low and keeping green all winter, attains to perfume, but not to honey.

The first honey is perhaps obtained from the flowers of the red maple and the golden willow. The latter sends forth a wild, delicious perfume. The sugar maple blooms a little later, and from its silken tassels a rich nectar is gathered. My bees will not label these different varieties for me as I really wish they would. Honey from the maple, a tree so clean and wholesome, and full of such virtues every way, would be something to put one's tongue to; or that from the blossoms of the apple, the peach, the cherry, the quince, the currant,—one would like a card of each of these varieties to note their peculiar qualities. The apple-blossom is very important to the bees. A single swarm has been known to gain twenty pounds in weight during its continuance. Bees love the ripened fruit too, and in August and September will suck themselves tipsy upon varieties like the sops-of-wine.

The interval between the blooming of the fruit-trees and that of the clover and raspberry is bridged over in many localities, by the honey locust. What a delightful summer murmur these trees send forth at this season! I know nothing about the quality of the honey, but it ought to keep well. But when the red raspberry blooms, the fountains of plenty are unsealed indeed; what a commotion about the hives then, especially in localities where it is extensively cultivated, as in places along the Hudson! The delicate white clover, which begins to bloom about the same time, is neglected; even honey itself is passed by for this modest, colorless, all but odourless, flower. A field of these berries in June sends forth a continuous murmur like that of an enormous hive. The honey is not so white as that obtained from clover, but it is more easily gathered; it is in shallow cups while that of the clover is in deep tubes. The bees are up and at it before sunrise, and it takes a brisk shower to drive them in. But the clover blooms later and blooms everywhere, and is the staple source of supply of the finest quality of honey. The red clover yield up its stores only to the longer proboscis of the bumble-bee, among our native bees, else the bee pasturage of our agricultural districts would be unequalled. I do not know from what the famous honey of Chamouni in the Alps is made, but it can hardly surpass our best products. The snow-white honey of Anatolia in Asiatic Turkey, which is regularly sent to Constantinople for the use of the Grand Seignior and the ladies of his seraglio, is obtained from the cotton plant, which makes me think that the white clover does not flourish there. The white clover is indigenous with us: its seeds seem latent in the ground, and the application of certain stimulants to the soil, like wood ashes, causes them to germinate and spring up.

The rose, with all its beauty and perfume, yields no honey to the bee unless the wild species be sought by the bumble-bee.

Among the humbler plants let me not forget the dandelion that so early dots the sunny slopes, and upon which the bee languidly grazes, wallowing to his knees in the golden but not over-succulent pasturage. From the blooming rye and wheat, the bees gather pollen, also from the obscure blossoms of Indian corn. Among the weeds, catnip is the great favorite. It lasts nearly the whole season and yields richly. It could no doubt be profitably cultivated in some localities, and catnip honey would be a novelty in the market. It would probably partake of the aromatic properties of the plant from which it was derived.

Among your stores of honey gathered before Midsummer you may chance upon a card, or mayhap only a square inch or two of comb, in which the liquid is as transparent as water, of a delicious quality with a slight flavor of mint. This is the product of the linden, or bass-wood, of all the trees in our forest the one most beloved by the bees. Melissa, the goddess of honey, has placed her seal upon this tree. The wild swarms in the woods frequently reap a choice harvest from it. I have seen a mountain side thickly studded with it, its straight, tall, smooth light-gray shaft carrying its deep-green crown far aloft, like the tulip or maple.

In some of the north-western States there are large forests of it, and the amount of honey reported stored by strong swarms in this section, during the time the tree is in bloom, is quite incredible. As a shade and ornamental tree the linden is fully equal to the maple, and if it was as extensively planted and cared for, our supplies of virgin honey would be greatly increased. The famous honey of Lithuania in Russia is the product of the linden.

It is a homely old stanza current among bee-folk that

> "A swarm of bees in May
> Is worth a load of hay;
> A swarm of bees in June
> Is worth a silver spoon;
> But a swarm in July
> Is not worth a fly.

A swarm in May is indeed a treasure; it is, like an April baby, sure to thrive, and will very likely itself send out a swarm a month or two later; but a swarm in July is not to be despised; it will store no clover or linden honey for the "Grand Seignior and the the ladies of his seraglio," but plenty of the rank and wholesome poor man's nectar, the sun-tanned product of the plebeian buckwheat. Buckwheat honey is the black sheep in this white flock, but there is spirit and character in it. It lays hold of the taste in no equivocal manner, especially when at a winter breakfast it meets its fellow, russet buck-wheat cake. Bread with honey to cover it from the same stalk is double good fortune. It is not black either, but nut-brown, and belongs to the same class or goods as Herrick's

> "Nut-brown mirth and russet wit."

How the bees love it, and they bring the delicious odour of the blooming plant to the hive with them, so that in the moist warm twilight the apiary is redolent with the perfume of buckwheat.

Yet evidently it is not the perfume of any flowers that attracts the bees; they pay no attention to the sweet-scented lilac, or to heliotrope, but work upon sumach, silkweed and the hateful snapdragon: In September, they are hard pressed, and do well if they pick up enough sweet to pay the running expenses of their establishment. The purple asters and the golden-rod are about all that remain to them.

Bees will go three or four miles in quest of honey, but it is a great advantage to move the hive near the good pasturage, as has been the custom from the earliest times in the Old World. Some enterprising person, taking a hint perhaps from the ancient Egyptians, who had had floating apiaries on the Nile, has tried the experiment of floating several hundred colonies north on the Mississippi, starting from New Orleans and following the opening season up, thus realising a sort of perpetual May or June, the chief attraction being the blossoms of the river willow, which yield honey of rare excellence. Some of the bees were no doubt left behind, the amount

of single honey seasons must have been very great. In September the colony should have begun the return trip, following the retreating summer south.

It is the making of the wax that costs with the bee. As with the poet, the form, the receptacle, gives him more trouble than the sweet that fills it, though to be sure, there is always more or less empty comb in both cases. The honey he can have for the gathering, but the wax he must make himself—must evolve from his own inner consciousness. When wax is to be made the wax-makers fill themselves with honey and retire into their chamber for private meditation: it is like some solemn religious rite; they take hold of hands, or hook themselves together in long lines that hang in festoons from the top of the hive, and wait for the miracle to transpire. After about twenty-four hours their patience is rewarded, the honey is turned into wax, minute scales of which are secreted from between the rings of the abdomen of each bee; this is taken off and from it the comb is built up. It is calculated that about twenty-five pounds of honey are used in elaborating one pound of comb, to say nothing of the time that is lost. Hence the importance, in an economical point of view, of a recent device by which the honey is extracted and the comb returned intact to the bees. But honey without the comb is the perfume without the rose,—it is merely sweet, and soon degenerates into candy. Half the delectableness is in breaking down these *frail and exquisite walls yourself*, and tasting the nectar before it has lost its *freshness* by contact with the air. Then the comb is a sort of shield or foil that prevents the tongue from being overwhelmed by the first shock of the sweet.

The drones have the least unenviable time of it. Their foothold in the hive is very precarious. They look like the giants, the lords of the swarm, but they are really the tools. Their loud, threatening hum has no sting to back it up, and their size and noise make them only the more conspicuous marks for the birds. They are all candidates for the favors of the queen, a fatal felicity that is vouchsafed to but one. Fatal, I say, for it is a singular fact in the history of bees, that the fecundation of the queen costs the male his life. Yet day after day the drones go forth, threading the mazes of the air in hopes of meeting her whom to meet is death. The queen only leaves the hive once, except when she leads away the swarm, and as she makes no appointment with the male, but wanders here and there, drones enough are provided to meet all the contingencies of the case. One advantage results from this system of things; there is no incontinence among the males in this republic!

(To be continued.)

AMERICAN EXPORTS—1878.

BY the statements and reports from the Bureau of Statistics, the following general results are shown, according to an American paper.

That for the year of 1878, the exports of our country exceeded the imports by 250,000,000 dols., in round numbers.

Our principal exports as stated by Government reports are:—

	Dollars.
Breadstuffs	110,000,000
Cotton and its manufactures	120,000,000
Tobacco and its manufactures	120,000,000
Woods, lumber, timber, etc.	25,000,000
Sugar	6,000,000
Provisions of all kinds, beef, pork, lard, hams, etc. ..	90,000,000
Oils of all kinds	50,000,000
Leather	7,500,000
Machinery, hardware, cutlery, etc.	12,000,000
Tallow	6,000,000
Furs and skins	4,000,000
Coals (to Newcastle)	2,000,000
Flax seed and other seeds	2,500,000
Total of products named ...	445,000,000

These are the leading articles, and all were formerly imported from Europe more or less—our combined exports for 1878 amounted to over 550,000,000, dols.—*Journal of Applied Science*, 2-6-79.

PROTECTION OF WOOD FROM ROT.

IN *Landwirthschaft und Industrie*, Herr K. Fleischer, of Gonobitz, thus describes his accidental discovery of a means of preserving wood from rotting. Four years ago he set about making a preparation of coal-tar and ashes for the purpose of driving away ground fleas and beetles from his garden. Just as he had mixed the materials together he was called away from his work, and, on returning, found to his surprise that, instead of tar in the ashes, there was a kind of woody texture in its place. Astonished at the transformation, he tried the experiment over and over again and invariably with the same result. Just about this time he had occasion to refloor an out-door room, where the boards came into almost immediate contact with the ground, and took the opportunity of testing the preservative effects of this mixture by smearing the under side of the planks with coal-tar, and sprinkling them liberally with ashes, a thin layer of which latter was also sifted over the ground. The procedure proved eminently successful, for the floor is still in perfectly good condition, and not in the least attacked by fungus growth, while on all previous occasions, though laid down in equally good material, it had always required constant repair in a very few months' time, and was generally thoroughly rotten in less than two years. Herr Fleischer has since tried the same application on the wood-work of hot-beds and forcing-houses with equally satisfactory results.—*Country Gentleman's Magazine*, July 1879.

THE SEPARATION OF CREAM FROM MILK.

A SHORT time ago we drew attention to the application of centrifugal force to the separation of cream from milk, and to the experiments made at Copenhagen by Mr. Fjord with Lefeldt's Centrifuge. These experiments showed that by means of this machine a more complete separation could be effected than had previously been attained by any process. However perfect in its operation this machine may be, it has a number of drawbacks, which tend to prevent its speedy and general adoption. Its price is high, being upwards of £150. That might be reduced, because the machine is of simple construction; but it requires three horse-power to drive it, which is both expensive, and, in many cases, highly inconvenient. Last of all, it is not continuous in its action, but has to be stopped every half-hour, that it may be emptied and refilled. All these disadvantages having been removed in a machine invented by a Swedish engineer, and called, from its inventor, 'De Laval's Separator.' Separator is too vague a word; and we would propose to substitute for it, 'Creamer,' as more expressive of its purpose.

The price of the Creamer is about £25; it requires only the power of two men to drive it, and its action is continuous. As long as it is kept in motion and supplied with milk, it will deliver cream at one spout and skim-milk at another. De Laval's Creamer has been at work through last spring at the Swedish School of Agriculture at Alnarp, and Professor Hjalmar Nathorst gives his opinion of it in the following terms:—'De Laval's Separator, in my judgment, takes the first place among machines now known for skimming milk. It is simple, easily managed, easily cleaned, requires very little power to drive it, works exceedingly well, and is cheap; so that it possesses all the conditions required to bring it into general use.' Professor Nathorst is carrying on experiments with this Creamer, which are not yet concluded. He states, however, that though at Alnarp a very small quantity of milk is required to produce a pound of butter by the ice method, the Creamer has given a yet better result. The maker claims for this machine that it leaves in the milk only 3-10ths per cent. fat. To state it in another way, of 1,000 lbs. of cream it will separate 997 lbs., and leave in the skim-milk only 3 lbs. De Dayal's Creamer possesses all the advantages of that class of machines. It requires no ice, and thus avoids the expenses and inconveniences of the ice method. It saves the room and the vessels required for holding milk for 24 or 36 hours, and it yields perfectly fresh cream and milk, which are in consequence, of better quality than ordinary.

This remarkable machine will be exhibited at the London Show of the Agricultural Society of England, where it will doubtless attract great attention. A. L.

Cherryvale, Aberdeen.—*North British Agriculturist*.

ARTESIAN WELLS IN PONDICHERRY.

A REPORT has been published by the Pondicherry Government on the operations carried on with artesian wells in the settlement under an officer of the administration. Some time ago success was achieved by the sinking of an artesian well in connection with a spinning factory at Pondicherry, and it was consequently resolved to extend operations. The engineer officer who conducted the experiments is of opinion that during periods of famine, such as those which the presidency has lately tided over, these artesian wells will be of great use. If the difficulty of obtaining water cannot be quite overcome by their use, the disastrous consequences of famine might be greatly mitigated by sinking artesian wells. The real cost of sinking a well will be about five thousand francs. At Pondicherry or certain parts of it, three wells were constructed with the aid of these new machines within a radius of eight hundred metres of each other at depths varying from 38'53 to 79'52 metres. The Ingenieur Colonial chef du service des Ponts et Chaussees has been careful to preserve a complete collection of geological specimens of the strata penetrated, and a case containing an extract from the register of boring, with the specimens and bottles of water, have been deposited at the Magazin General. The report submitted to the Madras Government has been perused with much interest by his Grace the Governor in Council, who has referred the question of sinking artesian wells to the D. P. W., Irrigation Branch, for early consideration.

THE OLIVE IN BURMAH.

WE have seen some of the fruit and leaves of the Burmah olive *(Salwoanthes)*, and to judge from the shape, the leaves, the seed the taste, and even the smell, there can be no doubt of the identity of this *Salwoanthes* with the olive. An Italian gentleman of our acquaintance took the trouble to send to Italy for some leaves of the Italian olive and from a comparison with the leaf of the Burmah species which shows a slight difference, *viz.*, in the latter being serrated or dented at its edge and coarse ribbed, while the former is not, he is firmly convinced that the fruit in question is one of the numerous species of the olive. It should be noted however, that according to a French work, the leaves of the French olive are slightly serrated.

The peculiarity of the *Salweenthea* is that some of its leaves are serrated while others on the same tree are smooth; the seed of the half-grown fruit [illegible] at both ends goes off to a sharp point, whereas the matured seed is exactly like that of the ordinary French olives we buy in shops.

Wallich in his account of his travels mentioned 40 years ago that he had met the olive in the Salween district, and it is surprising to us how the Forest Department, composed as it is supposed to be of men of scientific training, should have overlooked this most valuable tree, the fruit of which the Burmese eat both dried and salted. The original habitat of the tree was Asia, being introduced by the Phoceans into Europe about the time they established their colony in Provence. It does not thrive in cold climates. In France alone there are over 30 different species, so that it is no wonder there should be some slight difference between the Burmese olive and the Europe species. What further confirms us in our opinion that the *Salweenthea* belongs to the same family as the *Olea Europæa*, is that in the French work before referred to by us, it is stated that the leaf of the olive is of a somewhat acid taste, and this peculiarity is distinctly perceptible in that of the *Salweenthea*.

The leaf when reduced to powder has medicinal properties, being an astringent and a febrifuge, and it was at one time used in the same way as quinine, in the treatment of intermittent fevers. The non-employment of this leaf as a medicine now is more due to the existence of cheaper and more active tonics, such as gentian, oak bark, &c., which are equally indigenous in Europe.

We trust the local Government, instead of trying to raise a revenue by encouraging convict competition with honest labour, may see its true interests in encouraging the cultivation of this valuable fruit tree.—*Rangoon Gazette*.

THE GUANGO.

THE writer of the paragraph about *guango*, to which our correspondent ETCETERA referred in one of his "Notes by the Way" yesterday, sends the following reply:—

The writer of "Notes by the Way" takes me up very short on the matter of my advocacy of *guango*. What I meant to say was not that *guango* was to supersede all fodder for cattle now in use, but that it might be utilised as a valuable adjunct. In just the same way is the mangrove —I cannot think of its botanical name just now—used. The banks, of the estuary running up from the sea at Masulipatam to the Custom House in the "pettah" are of a very oozy character; the stream frequently showed a disposition to make new diversions for itself, and Mr. Rohde, then Judge at Masulipatam, hit upon the expedient of sowing mangrove seeds along the banks for the purpose of strengthening them, and giving them that power of cohesion which they wanted. Mr. Rohde succeeded admirably. The mangrove "jungle" of Masulipatam is now one of its recognised land-marks, and the owners of cattle are largely indebted to it for its suitability as fodder for cattle, The use of the leaves does at first produce diarrhœa among the cattle —horses never use it, but they become accustomed to it in time, and get over the effects at first produced. So partial are buffaloes, especially, to the mangrove leaves, that they have been known to keep away for weeks together in the bush. The fact of the *guango*, under certain conditions, disagreeing with cattle, ought not, I think, to be employed as an argument against the use of it at all. Fresh grass, your "Notes'" writer admits, does sometimes produce disagreeable effects; why should exception be entirely taken against the *guango* for doing the same?—*Madras Times*.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 24th July 1879.

RAJAH SUTTYANUND GHOSAL, BAHADOOR, *V.-P., in the Chair*.

THE proceedings of the last meeting were read and confirmed.

The following gentlemen were elected :—

Ordinary Members.—Messrs. H. P. Rushton, G. R. Aberigh-Mackay, Sorabji Dadabboy, A. C. Brett, J. B. Woosman, and J. C. Grieff.

Honorary Members.—Lieutenant-General Sir Arthur Phayre and Baron Ferdinand von Mueller.

The names of the following gentlemen were submitted for membership :—

C. F. Worsley, Esq., C.S., Mozufferpore,—proposed by Mr. H. W. Stevens, seconded by the Secretary.

Rajah Muttobur Sing, Chowdry Bazaar, Cuttack,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

Thomas Anderson, Esq., Merchant, Calcutta,—proposed by Mr. Leitch, seconded by Mr. S. H. Robinson.

C. H. Brookes, Esq., Settlement Officer, Port Blair,—proposed by the Secretary, seconded by Mr. R. Blechynden.

E. D. M. Hooper, Esq., Forest Department, Nagpore,—proposed by Dr. G. King, seconded by Mr. Robinson.

COMMUNICATIONS.

A small quantity of seeds of tuberous Begonias from S. Jennings, Esq.,

Seeds of trees of sorts from the Andamans,—from E. H. Man, Esq.

A quantity of Mahogany seed and seed of *Bambusa stricta*,—from Dr. G. King.

Ferns and other plants from the Neilgherries,—from F. Lazarus, Esq.

GARDEN.

The Head Gardener's monthly report was read, of which the following are extracts :—

"The weather has been seasonable, and trees and shrubs in the garden are reviving under the influence of the late copious showers and the heat combined. Our tanks are filling rapidly—our fences around the garden have been repaired. Rose layering was finished some time back; layers and cuttings of various kinds of flowering shrubs are also far advanced. Lichee 'gotees' commenced about a week ago. Mango in arching will commence to-morrow. The increase of fruit trees should be one of our principal objects, as the demand for fruit trees seems on the increase this year as compared with last season, but our staff of *malees* is meagre. Thousands of cuttings of ornamental-leaved plants have been put down; a fuller list will be given next month. We have several thousands of young tamarinds which ought to be shifted soon, as we require the space which they occupy; they are superior to the ordinary kind, the pulp being sweeter. We have received a small quantity of Messrs. Ohlendorff's manure. We have had no full opportunity as yet of trying its effects on various fruit trees, &c., but some ordinary native maize seed from the Shahabad district was sown on 17th June 1879, on poor and over-damp land, and part received a mere sprinkling of this manure; the manured plants and unmanured ones are sent for inspection. [The one is twice the length of the other.] We also send a few flowers of double Hibiscus,—namely, *H. rosa sinensis, Kermisianus*, and *Rosa sinensis miniatus semi plenus*, Of contributions several kinds of the Andaman seeds have germinated :—*Vatica robusta, Urania madagascariensis* and *Casuarina* seedlings received from Royal Botanic Gardens, Howrah, are all progressing favourably; a small collection of ferns in excellent condition have been received from Mr. F. Lazarus; *Roana luxurians* has been sown. The Mahogany seeds sown on 5th July germinated several days ago. Of *Coffea liberica* we have secured altogether about 120 seeds, a few of which have germinated; but as they take 6 or 8 weeks to germinate, we cannot yet form any opinion as to the number of plants we shall get finally."

HIMALAYAN ONION.

Read the following extract of a letter from Captain J. F. Pogson :—

"By this day's pattern-post I have despatched to your address a packet containing twelve roots of the onion indigenous to these hills. I believe they grow wild up in Kunawar.

"The botanical name *Allium leptophyllum* does not appear in either the British or Indian *Materia Medica*; I have found it in *Johnston's Chemistry of Common Life*, page 443, q.v.

"I should like these onions to be put down and propagated, if feasible, in Bengal.

"I tried four yesterday, minced up, and beaten into an omlette. The taste was very good, but half an hour after eating it I felt very warm and broke out into a very profuse perspiration, which could only have been due to the onions, as beyond pepper and salt, nothing else was used in the preparation of the omlette.

"I tasted a good slice of the onion in its raw state. It was strong and very pungent, much more so than any common bazaar onion of the plains.

"This sudorific quality is of value, for the onions (all the tribe) are most nourishing; and if the present variety is medicinally sudorific, it will meet and supply a long-felt want.

"I have put down a lot of roots, and hope by-and-bye to secure the seed.

"The favourite way of eating this *Allium* is to cut the green stems, and to grind them down into a paste on the curry stone, and then to use this leaf paste with other condiments in making up a curry, meat or vegetable."

The Secretary stated that these bulbs had been sent to the garden for immediate sowing. He also called attention to a paper in the Society's Journal, Vol. II, p. 453 (old series), in which reference is made to the Himalayan onion as of superior quality.

Letters were also submitted—

(1)—From Messrs. Williamson, Magor & Co., sending specimen of an insect which is doing much mischief to the tea bushes in the Munguldye Company's plantation.

(2)—From the editor of the *Indian Tea Gazette*, specimen of what is described "as a new form of blight on tea bushes in Assam." The above have been forwarded to the kind care of Mr. Grote for the inspection of the Scientific Committee of the Royal Horticultural Society.

(3)—From R. Macallister, Esq., presenting some cobs of American maize grown in a cold latitude to meet the request of Mr. Buck, as notified in last month's proceedings. These cobs were immediately forwarded to Mr. Buck, who tenders his best thanks for Mr. Macallister's courtesy.

(4)—From H. A Firth, Esq., submitting an account of a grand show of the Royal Agricultural Society of British Guiana. Some of the fruits and vegetables introduced in the schedule are, Mr. Firth observes, very like the products of Bengal.

(5)—From the Officiating Secretary to the Government of India, Home, Revenue, and Agricultural Departments, giving some information in respect to the introduction and culture, in the Andamans, of *Musa textilis*, of which a specimen of fibre, with report thereon, was submitted at the last meeting.

(6)—From Captain Pogson, a paper on the cultivation of Chicory, by Indian Tea, Coffee, and Cinchona Planters as an article of export to Europe;

The above two papers were transferred for publication in the journal.

THE GARDEN.

THE *Gardener's Chronicle*, referring to the vitality of fungus spores, says:—"The question has not unfrequently been asked as to how long the resting-spores of the potato fungus will, under favourable conditions, preserve their vitality. We are not aware that any definite answer has been given to this particular question, but we have a paper before us by M. Orie, in which he shows that stylospores of Pestalozzia, preserved for more than half a century in the herbarium, germinated as readily as those which were taken freshly from the host plant on the same day."

HINTS ON MELON GROWING.

SOME of the following suggestions by a correspondent of the *Fruit Recorder* may be profitably adopted now, though the plan which he proposes is to make the melon bed in the autumn.

I am a great lover of melons, and although I have lived in Philadelphia nearly all my life, have only found really fine melons in this great State of Nebraska. I have a peculiar way of raising them, and as the Fall is the proper time to make a melon patch (I am now enlarging mine to meet an increased demand), I will describe my way for the benefit of your many readers. Select any piece of sandy land well exposed to the sun; if all pure sand, so much the better. Plough dead furrows, six feet apart, twenty-four inches deep, in straight lines from north to south. Fill these up with strong manure, old or new, and plough the earth back to bury the manure and form a ridge; level the top with the back of the harrow. At each end plant a stout stake to remain as an indicator of the exact position of the centre of the ridge. You now have a perpetual melon patch for ten years at least. In the spring stretch a garden line from stake to stake and at every six feet plant six seeds in a twelve inch circle, and four or five radish seeds in the centre. The bugs will not touch the melon plants as long as the radishes grow there. Let all the seeds grow; do not thin them out, and keep out the weeds until the vines begin to show runners; then mulch the whole patch with straw, hay, fresh-cut grass, or anything that will keep the surface moist and the fruit from the ground. As soon as the frost kills the vines, gather all fruit above eight inches in diameter, and stow it away in a sunny corner under some new hay. In this way I have melons ripening slowly and finely until the weather gets too cool to eat them. Next year plant your seed a foot or two north or south of the old hills, and so on yearly to obtain the whole ridge. The roots follow the ridge, and the cultivator can be run through the spaces without disturbing the roots. I grow the Long Island, Black Spanish and Mountain sweet water-melons, and the green citron, Alton large and white Japan citron melons. We do not drink oceans of cold water during haying and harvesting, as is the custom in many places in the East, but draw largely upon our melon patch, to the unbounded delight and comfort of all hands.—S. B. in the *Fruit Recorder*.

CULTURE OF ALOCASIAS.

(FROM THE GARDEN.)

THOSE of the *A. metallica*, *Veitchi* and *Lowi* section do much the best in very light material, using nothing but fibre, with the earthy portion of the peat removed, mixed with about two-fifths of chopped sphagnum (cocoanut fibre may be substituted in this country), to, say, a sixth part of rotten, dry, flaky manure, such as may have been used for summer mulching a vine border or wherever it would be similarly exposed to like drying influences of sun and air; to this should be added a good proportion of sand and a liberal sprinkling of pot shreds and charcoal. In a mixture of this sort these plants will grow and increase to an extent not possible in ordinary potting material. They are much better wholly, or almost wholly, shaken out so as to get the old soil entirely away from them. It is best, also, in repotting to take the small crowns and offsets away, keeping the stronger growths by themselves and treating the weaker ones in like manner. They are very shallow rooters, consequently the pots should be half filled with drainage, similar in this respect to orchids. A *Jenningsi* is one of the most beautiful of the small-leaved kinds; it will do well in material such as the above, putting either a number of the crowns together in shallow pots or pans, or in the shape of small plants for placing about amongst the other occupants of the stove. *A. macrorhiza variegata*, although from the quickness with which it may be increased, is not thought so much of as some of the scarcer kinds of recent introduction, it is one of the handsomest and most effective plants which we possess. In the matter of soil it requires to be quite differently treated from the others; it is hardly possible to make the material in which it grows too rich; one-half yellow loam to an equal proportion of thoroughly rotten, dry manure, and one-sixth sand, will in every way suit it. In selecting young offsets of this *Alocasia*, those should be chosen that have somewhere near an equal proportion of green and white in their leaves; suckers with too great a preponderance of white are deficient in vitality to grow freely, whilst, on the other hand, those that contain too much green in their early stages seldom attain colour enough to make them attractive.

FORESTRY.

THE *Indian Forester*, Vol. V., has an article taken from the *Scientific American*, which tells us that the destruction of forests in America is going on at the rate of 7,600,000 acres annually, and that this has been steadily going on since 1835, consequently since that date 522,500 square miles of forest have been destroyed. This is most suicidal, and we should think that with the light thrown by scientific investigation of late years on this subject, the authorities would intervene to prohibit this wholesale destruction.

THE Mahogany promises to adapt itself to the climate of the Central Provinces. In the garden of the Horticultural Society, Nagpore, are some very promising species. The narrow-leafed iron bark also promises to succeed at the same station. At Seoni there are some trees of the *Eucalyptus globulus* one foot in girth and about 20 feet in height, which have withstood the past hot season and developed entirely new foliage, while several less promising specimens, cut down to the ground, are throwing up vigorous new shoots.—*Madras Mail*.

THE JAPAN FORESTS.—The Japanese Government appears to be following in the steps of the Indian Government with regard to the forest motion. The *Japan Mail* of a recent date has the following:—"As the authorities have determined to establish a branch of the office for the preservation of forests in Yamaguchi *Ken*, a number of officers from the head-quarters in the Naimusho will shortly proceed to the *Ken*. The subject of the preservation of existing forests, and the replanting of such as have been destroyed through waste, negligence or accident, has been receiving great attention on the continent of Europe and in India for some years past, and the Japanese Government are exercising a wise discretion in enforcing a proper system of management in the forests of this country.—*Times of India*.

THE SEQUOIAS.—Mr. John Muir has an interesting paper in *Harper's* upon the "New Sequoia Forests of California." He gives therein the details of a discovery by himself of a grand forest of Sequoias 70 miles long, lying considerably south of the isolated groups hitherto known, and containing large numbers of saplings, which indicate that the species is still in a vigorous state of existence. It has heretofore been argued that the few groups of these trees known made it probable that the species was dying out from its last strongholds upon the earth, for it has come down to us from pre-glacial times, when it existed in Europe also, as geology testifies. Mr. Muir's researches lead him to believe that the species has never been more extensively distributed on the Sierra in post-glacial times than it is now; and that to-day it is as full of life and vigour as it was 10,000 years ago.

TREES FREEZING SOLID.—The *Country Gentleman* states that Dr. Hoskins, who lives in the coldest part of Vermont, where the mercury sometimes freezes, says that when this takes place, he does not think that any portion of the sap of the trees remains unfrozen; yet the hardier varieties endure this cold unharmed. "We have observed," says the editor, "the shoots of the apple, pear, and peach frozen stiff (when the thermometer sank to 10 deg. above zero) without injury. The microscope showed them to be filled with ice crystals, no injury resulting from the freezing."

THE following extract from "The Travels of Pallas through the Southern Provinces of Russia" contains a very interesting account of the effect of frost and rain combined on forest trees (p. 55). An illustrative vignette is given at p. 88. "Our curiosity was gratified by the new and uncommon appearance of the trees, of which we had received an imperfect idea in the former part of the journey. The cause of this singular phenomenon is as follows:—Severe hoar frosts had commenced in these regions before Christmas, and were followed by snow mixed with rain or sleet, so that even the smallest branches of the trees were covered with ice an inch thick; by this all the flexible birch trees had been bent to the ground in semi-circles. Their tops and branches were thus buried under the continual snow, which lay upwards of a yard deep, and kept the trees in that recumbent state. The inflexible full-grown birch and oak trees had been partly split and partly broken by the weight of the congelation on their tops, while their collateral branches were also bent to the ground. The thaw, which began here towards the latter end of February, and the rays of the sun, had indeed

melted the icy incrustation on the upper part of the trees, but, it still remained undissolved on the branches which were fixed in the snow. The cylinders of ice on one side all appeared melted into a solid mass ; but on the lower part they were crystallized in hexagonal and partly in rhomboidal figures, which thus consisted of hexagonal sections."—M. J. B. in *Gardener's Chronicle.*

THE *Journal of Forestry* says :—" We regret to find that no attempt has yet been made to reduce the enormous expense to which the country, and the parents or guardians of a pupil, are put to pay for his training in the forest school at Nancy, an institution too, be it observed, that does not at all meet the requirements necessary for the *proper* training of first-class forest officers for the management of the forests in British India or in the colonies. Each pupil costs, for fees and maintenance, £220 per annum, of which heavy sum the parents are held liable to pay £180, which may be reduced to an average of £120 per annum by the industry and good conduct of the pupil ; in reward for which the Government, at its discretion, pays the difference, £60 per annum.

"Such heavy charges can only be afforded by the opulent classes, and very much exceed the cost of training for any other profession in this country. They are also quite prohibitory to the young men best qualified by nature and early training for filling the office of forest officers in India or elsewhere. For less than half that cost per head per annum we train our clergy, doctors, lawyers, naval and military officers, engineers, &c.,* in fact, we do not know of any professional training which necessarily requires such an enormous expenditure for such poor results. Suppose there is an annual average of fifteen pupils being trained at Nancy for the Indian forest service. This would give a total cost of £3,300 per annum. Such a large sum properly expended in training forest students in a Forest Department in connection with any of our universities would train fifty students in place of fifteen, and make much superior men of them, for the duties they are called on to perform in the management of our home, colonial, and Indian forests. The *special* training for India, or any colony, should be taught in that country. The science and technics of forestry can be better and more economically taught in Britain than anywhere else, and the practical training specially necessary for any particular country, cannot be so well taught anywhere as on the spot where it has to be put into practice."

May we ask, why send these aspirants to France at all, are there no forests in England or in Scotland, and is the science of forestry so low at home, that we have to send our students abroad for their education.

FORESTS AND RAINFALL.

THE subject of our present remarks has occupied our attention on many previous occasions, and the correspondence on the same subject, which has appeared in our columns and in those of our contemporaries, has been frequent and conflicting. Although the subject appears to be exhausted, we find it treated in such an interesting manner, in the columns of the *Bombay Gazette*, that we are induced to refer to a letter which there appears from the pen of the Professor of Geology in the Civil Engineering College of Poona.

The Professor commences by stating what he believes to be the correct and scientific way of explaining the manner in which the growth of forests tends to influence rainfall. He sets out by placing before his readers the fact, that the mean annual temperature of the whole earth is well recognised as constant ; it averages the same one year with another, and consequently it follows, that the quantity of heat received during each year from the sun is balanced by an equivalent loss of heat. It has been supposed that this loss was occasioned by radiation into space ; but the Professor proceeds to shew that this is not the case ; that the amount of sun heat annually received by the earth is equal in amount to the heat required to melt a coating of ice 80 feet in thickness all over the globe ; and that the mean annual radiation of heat from the whole earth is equivalent to melt a coating of ice only 28½ feet in thickness. There is, therefore, a balance of heat received equivalent to the melting of 51½ feet of ice to be accounted for, as the mean temperature of the earth's surface is not increased.

In answer to the question as to what becomes of the balance, the Professor tells us that it is converted into another form of energy, *viz ;* vegetable life, and therefore ultimately into animal life. It is an established fact, that the growth of vegetation is accompanied by a disappearance of heat ; for, as every chemist knows, the resolution of a compound (*i. e.,* the separation of its elements), is invariably accompanied by a reduction of temperature. And what are the green leaves of the forest continually doing, while under the influence of the radiant energy emitted by the sun, but resolving or separating the elements of the carbonic acid gas—storing its carbon and liberating its oxygen—present in the atmosphere ? And this chemical decomposition is like others of its kind, accompanied by a fall of temperature—an absorption of heat. It therefore follows that, in addition to the generally acknowledged physical cooling that takes place at night, over the leaf surface of a forest, owing to the great radiating power of the green leaves, there is also a chemical action going on during the day-time tending to produce a reduction of temperature over the forest surface.

From this point we are led to the consideration of the most important condition tending to influence rainfall, to induce a more or less saturated wind to part with some portion of its watery vapour ; and we are further told, in conclusion, what has often been previously stated by other writers, though not nearly so clearly, that the reduction of temperature over a large area tends materially to influence rainfall. He does not indulge in the theory, that the planting up of isolated patches of forests over portions of an arid country, can in any degree influence rainfall, but he maintains stoutly that the planting of treeless hills and ridges, will materially affect the temperature of that portion of the country covered with forests of ample growth.—*Ceylon Times.*

THE INDIAN FOREST DEPARTMENT.

A CONSIDERABLE amount of public attention is again being devoted to the vital subject of tree planting in India, and the preservation and judicious utilizing of the existing forests of that country. Many able letters have appeared in the *Times* and other leading papers, pointing out the hurtful extent to which denudation has been carried on in several sections of that wide-spread empire, and the evils which have necessarily followed the complete clearance of forest trees from extensive areas of dry and sun-parched lands. The efforts now being made by the Indian Forest Department to prevent further denudation appear to meet with only a partial success, arising from the extent to which the forests have already been destroyed in many districts, and the arbitrary manner in which the Forest Department insists on stopping all clearance of forest lands within the scope of its powers of interference. This is undoubtedly the effect of the unsuitable training received by the officers of the Forest Department in the French Forest Schools, and the application of the red-tape officialism taught there to the totally different circumstances of British India. Such egregious errors are the natural result of the training received and the ideas imbibed in a Forest School specially adapted to the circumscribed rule and limited wants of the French nation, but totally inadequate to meet the ever-varying wants and circumstances of the far-spreading British dominions.

The teeming multitudes that cultivate the rich but often treeless plains of India cannot have their scanty supply of timber totally cut off at short warning without suffering the greatest hardships for want of it, and incurring wasteful loss by being compelled to dry and burn the valuable manure, which ought to be applied to reviving the fertility of the exhausted crop-bearing land. Nevertheless, the hybrid officialism which rules the Indian Forests has committed this cruel and unnecessary wrong, through its inability to understand the primary and simple principles which guide rural life in India, and its disinclination to vary its mode of treatment to meet the wants and circumstances of the inhabitants of each district.

The arbitrary measures taken by the Forest Department to prevent denudation, and which are strictly enforced by its officials without the smallest thought or discrimination as to the varying wants and peculiarities of the inhabitants, are causing widespread discontent and unnecessary ill-feeling among the natives, who find their natural supply of timber and fuel peremptorily stopped, without having the means to supply the want from other sources. The consequence is, they have to starve their crops for want of manure, which they are driven to use for fuel when their supply of wood from the forests is abruptly cut off, or the price of it raised so high as to be totally beyond their powers to purchase.

In a country where the means of transport are still so difficult and costly, it is simply disastrous to enforce strict prohibitory laws against partial denudation of forest land Denudation must to a certain extent proceed, under well-defined and suitable regulations, until by planting and enforesting a quantity of wood is grown sufficient to enable the annual consumption to be balanced by the annual growth. In other words, the proper remedy for the present difficulties is the wise and careful utilization of existing supplies, combined with judicious and extensive planting and enforesting wherever such can be carried out to advantage.

A thorough investigation into the system and management of the Indian Forest Department has clearly become a pressing necessity, and a radical change in the method of training its officers is absolutely necessary, so as to thoroughly eliminate the antiquated ideas with which they have hitherto been crammed, and which have proved to be as unsuitable to the wants and circumstances of India, as they are well known to be preposterously behind in the march of modern progress and the actual demands of science and practice at the present day.

Along with these needful arrangements in the management of the Forest Department, and in accordance with the necessities and peculiarities of India, the Government should take every means to inculcate a taste for tree planting among the natives. The forest officers should be authorised to give the necessary instructions and advice to all who may desire to plant trees on their land, and nurseries should be formed under Government superintendence, wherever there is a demand for such young trees as they can supply. These should be sold to the natives at a nominal price ; and to further encourage them to plant a reduction or exemption from taxes for a certain number of years on the ground thus planted would no doubt induce many of them to plant portions of their land, and thus greatly increase the local supply of wood for fuel and the other demands for various purposes in the locality. In some districts, where the necessities of the case demand it, planting to a certain extent should be compulsory. Under well-devised regulations and the judicious management of properly trained and energetic officers, local planting would prove highly beneficial to the natives with their comparatively limited but necessary wants, and would greatly tend to foster a spirit of progress and good-will, where opposition to improvement and ill-feeling is rampant at present. Local wants being thus supplied in many instances by local produce, the Government forests would be relieved to a great extent from local and petty demands, and their produce could then be more advantageously devoted to supplying the general wants of the country and the State.—*Journal of Forestry.*

MINERALOGY.

W[illegible] we give [illegible] on a [illegible] interested in the subject. We have taken the advice of an expert, who says it is not limestone but quartz. If it should turn out to be what our correspondent imagines it to be, it might tend to lower the price of lime in Calcutta, Sylhet having practically a monopoly, and a high price necessarily resulting.

ON CORUNDUM FROM THE KHASI HILLS.

(BY. T. R. MALLET, F.G.S., GEOLOGICAL SURVEY OF INDIA.)

AMONGST the specimens lately transferred from the Economic to the Geological Museum, was one of "hone stone," locally known as "maushyrut," from the Khasi Hills. Its high specific gravity attracted my attention, and on examination it proved to be corundum. It is a finely granular, light-gray, or grayish-white rock, containing microscopically minute specks of a translucent, dark-red, mineral. It scratches topaz with ease. The specific gravity is 3·93. It appears from information obtained by Colonel Sherer, Deputy Commissioner of the Khasi and Jaintia Hills, to whom the matter was referred, that the mineral is procured at a village called Nongryniew "towards the north-west of, and at a distance of about two days journey from, Nongstoin." Nongstoin is the capital of a petty Khasi State, latitude 25° 31′, longitude 91° 20′. It would seem that there are no quarries of the stone, but that the villagers pick up pieces found loose on the surface, and use it locally, as before mentioned, for hone or rather grind-stones.

As the edge of the hills to the north-west of Nongstoin is about 30 miles from the place, and within 15 miles of the Brahmaputra, it would appear that the locality where the corundum is found cannot be very far from the edge of the hills, and that it is within a day or two's journey from the river, for carts or laden animals. If, therefore, the stone occurs in large quantity—a point respecting which no information is available—it is worth attention commercially. Corundum is found in large quantity in South Rewah, and notwithstanding the fact that it is more than a hundred miles from the railway, over a road of which the first third is execrable even for laden cattle, and impassable for carts, the corundum is exported to some extent to Mirzapore. The Khasi stone, therefore, if found near the edge of the plains, would be far more advantageously situated with respect to carriage. The Rewah corundum is a tougher, less easily-pulverized stone than the Khasi. Whether the powder of the latter, however, would do the same amount of work as that of the Rewah, is open, perhaps, to question. We are indebted to Colonel Sherer for a specimen of the corundum lately received, weighing about 20 pounds, and measuring about 4×7×9 inches. It had evidently been in use as a grind-stone.

IRON IN INDIA.

(A PROMISING PROSPECT.)

THE mineral resources of India, we are glad to find, have begun to claim the attention which they have long deserved. A small quantity of Barrakur pig iron, as we noticed the other day, has been despatched to the Woolwich Arsenal to be tested as to its suitability for conversion into steel, and the result of the experiments will be looked for with anxiety. Taken in conjunction with the fact of Bengal coal coming very largely into use now, there is a future before us of great promise. A corresponding improvement in the condition of the Bengal colliers has been noticed, and Central India, from all accounts, is expected to keep pace with the progress of Bengal. A million tons per annum is estimated to be the out-put, roughly taken, of the Bengal coal mines, though a much higher figure is claimed in certain quarters. "Their capabilities," the *Statesman* writes, "are practically unknown, owing to the outturns being regulated in most instances by the requisitions made for the supply." Hopeful as is the picture drawn for us by no inexperienced hand, it is a matter for regret that the allied industries of iron smelting and reduction have not only been failures, when tried, but leave little room for hope that they will emerge from the uncertainties which the question is beset with. Our anxiety, then, for favorable reports from Woolwich can be well understood. The unsatisfactory reports, under both these heads, which have been before the public from Kumaon, from Wurdah and from Barrakur, have hitherto thrown a chill into the bosoms of all interested in the iron-produce of India, and have in many instances, suggested the painful truth that certain industries among us, for which the appliances of machinery and skilled labour are required, cannot compete advan-[illegible] direction, we must remain [illegible] where we are now. The [illegible] indication of the presence of [illegible] introduced [illegible] civilization. If the value of any [illegible] country is to be [illegible] by its productiveness, [illegible] what our Indian mines and collieries will [illegible] and resources shall be directed towards improving [illegible] of Bengal [illegible] the exceptional conditions of coal, lime and [illegible] simultaneously it is not wisdom's teaching to [illegible], and we may go on increasing our resources, extending our manufactures in an ever-increasing ratio. With ripe skill and energy, and with the wealth which may be brought to aid in the development of these resources, we may challenge rivals to beat us in the contest of production. But if we unwisely neglect to avail ourselves of the capabilities that Providence has placed at our command, and if we continue to content ourselves with the rough and ready instruments that we now employ, it may be that at no distant period we shall have a bitter awakening from our sluggish dream, and that our title of possessors of a rich mineral country may sound in the ears of posterity, only as a reminiscence of glories never to return.—*Madras Times.*

THE ALPHA GOLD COMPANY.

THE *Ooty* paper tells us that the Alpha Gold Company has once more a prospect of resuming operations on its mine. Arrangements have been made with the Foreign and Colonial Tunnelling and Prospecting Company, Limited, which has its head-quarters in London, by which further capital, to the amount of £37,000, will probably be provided. The capital of the Company will be fixed at the nominal sum of £60,000. £10,000 of this has been sunk already, by the original promoters and shareholders. Another £10,000 will be alloted to the Foreign and Colonial Company in shares, on a new issue. The remaining £3,000 will be issued in fully paid-up shares to sundry creditors of the Alpha Company, who have advanced money to it. The sum of £37,000 is therefore the amount of cash upon which the newly-formed Company will proceed to work. The original shareholders started the mine on a cash capital of something like one-sixth of this amount, and speedily came to a stand for want of funds. The London Company possesses patents, plant, and machinery, and a skilled technical staff and organization specially adapted for the working and development of mines.

ORIGIN OF COAL.

THE first of a series of two lectures on the nature and origin of coal was lately delivered by Professor M'Coy in the Industrial and Technological Museum. Owing to the unfavourable state of the weather, there was a very small attendance. Professor M'Coy commenced his lecture by explaining that the word coal was more a commercial term than a scientific definition. He pointed out that coal is undoubtedly of vegetable origin, and is mainly composed of marsh plants which have undergone a slow decomposition excluded from the atmosphere. He described the change which takes place under such circumstances, the carbon and hydrogen uniting to form petroleum, paraffine and the other hydro-carbons, instead of being disseminated in the form of gas, as when vegetable matter is decomposed exposed to the atmosphere. The first process in the change from the growing vegetable to coal was the formation of peat, which contained a much higher proportion of carbon than wood; then lignite, in which the percentage of carbon was still higher. In cannel coal there was a still greater proportion of carbon, and then followed splint coal, steam coal, and house coal, in all of which the proportion of carbon steadily increased in the order named. Last of all was anthracite coal, which was nearly pure carbon. The term bitumenous coal was a mistake, as there was no bitumen in coal, though the materials of which bitumen consisted were all to be found, and he believed that all the series of bitumens had been gradually distilled from coal by subterranean heat leaving only the anthracite coal. Professor M'Coy said that at present he had only commenced the subject, which he proposed to consider further on another occasion, when he would point out in what portions of the earth the different kinds of coal were to be found. On the motion of Sir Redmond Barry, a vote of thanks was given to Professor M'Coy for his lecture.—*Australasian.*

[illegible]

TEA.

THE prospects of the experimental tea cultivation in the north of Champarun, are said not to be promising. The difficulty from want of water has not been got over, and the climate is unfavourable for Europeans.

THE demand for land for tea cultivation in the Sibsagar district seems to continue steadily. 15,300 acres were sold in 1878-79 under the thirty-years' lease rules for tea cultivation, against 10,457 acres in the preceding year, and there were, besides, 4,899 acres taken up for the same purpose under ordinary cultivation leases. Last year, the area so taken up on ordinary leases was 4,131 acres. The total area actually under tea is reported to have increased by 3,773 acres. The new depôt for landing coolies at Disangmukh has been felt to be a convenience by the gardens to which Dikhomukh was less accessible, and the Chief Commissioner has already stated his readiness to declare Dhansarimukh also a legal place of debarkation, for the benefit of the planters in North Lakhimpore, as soon as reasonable accommodation is provided by those who wish to make use of the depôt for the coolies who would land there.

THE reports from the various tea districts are very discouraging, and it is much feared that the outturn will be considerably under estimates. The weather is the cause. The early portion of spring was cold and dry, and then the rain came much more liberally than was desirable.

WE observe prices are not at all what they ought to be. Usually by the month of August, the prices obtained in Calcutta are better than those of earlier date, but it is not so this season, where the rate is keeping unusually low. Doubtless this is to a large extent owing to the immense quantities of cheap and inferior teas which are reaching London from China, for, it must be confessed, that the British public do not yet appreciate a really good tea, the great guide, in the majority of cases, being cheapness. This is, however, a temporary obstacle to the introduction of Indian tea to England. The China growers cannot long continue their present losing game, and it must be brought to a close very speedily.

WE observe a firm in London advertises tea for three shillings per pound duty paid, which they characterize as the finest "the world produces." This will be news. The same paper which contains the above, also has a note of an auction tea sale at which tea is sold at four shillings per lb. *in bond*. Coffee does not seem to advance as tea does. Is it because of over production, or because the mass of the people do not prefer it to other beverages? We are afraid the latter is the cause of the decadence, as although the quantity produced seems steadily to increase, that increase seems only to about keep pace with the normal increase of the population.

The increase per head of the quantity consumed does not seem to increase much; nay, in some countries this seems to be going back. Great Britain is an instance of the latter.

WE republish from the *Colonial Mail*, a full report of a public meeting held in the interests of the proposed Indian Tea Planters' Association, the head-quarters of which will be in London. The meeting, from every point of view, was a very successful one, and the proceedings were characterised by an amount of unanimity which promises well for the future of the tea planting interest in India. Such an association as that which has been formed can effect all that Sir Douglas Forsyth indicated, and it will serve materially to benefit the planting and commercial interests of India.

WYNAAD tea has been very favourably reported on from England, and planters at Wynaad are very glad to know that they can direct their attention to tea as well as to coffee. A correspondent however complains that Indian tea, though now considered by most people to be superior to that obtained from China, does not in England [illegible] country. [illegible] think [illegible] Indian tea while they are in India [illegible]

It is always found that we can get things cheaper and better in London than anywhere else. Is it not a fact that all the best meat and butter and strawberries, are carried off from Edinburgh and Glasgow to London, and sold cheaper there?—*Deccan Herald*.

THE DRAWBACKS TO SUCCESS IN TEA.

I.

WHEN tea was first introduced as a speculation, the greatest recklessness prevailed as to management, no amount of outlay being considered extravagant in the face of the profits, that report said, were to be realised from the business. These were never to be under 100 per cent., and might frequently exceed 200 per cent. With these ideas pervading the minds of those adventurous individuals who first risked their money, it is not to be wondered that grand ideas as to expenditure should have dominated in the councils of the promoters. Managers were sent to the tea districts, to commence on salaries which would now be considered liberal for a man of ten or fifteen years' experience. This suicidal policy continued till the collapse of 1864, immediately preceding which this extravagance reached its climax. Managers were, as a rule, paid four and five hundred a month; assistants commenced at two hundred and two hundred and fifty; and superintendents, of whom almost all companies had one, drew one thousand and upwards, with travelling expenses, &c., paid. Tea seed was purchased at famine prices, the commonest China commanding Rs. 100 to 150 per maund, and hybrid and indigenous fetching Rs. 210 per maund. Of course nothing could stand such recklessness, and the almost total collapse of tea was the result. At the same time "Limited" companies were rising up in England, and in India, and were buying up infant gardens, consisting for the most part of extensive grants of waste land, with a nursery of doubtful value, and a few straggling tea bushes planted out, and dignified by being said to be "under plant." These plants were put out at respectable distances, and without any particular regard as to future success, the grand object being present profit. These properties were bought up at enormous prices, varying from ten to one hundred times their value; but what of that? The two hundred per cent. profit would soon make that all right.

This collapse over, companies set themselves to find out how a saving could be effected in any and every possible way,—the mirage of the two hundred per cent. having now vanished,—various plans were adopted, and the result has been to a certain extent successful. Expenses in the garden are now much less than formerly, those at the agents' office have not been correspondingly cut down, and although the expenditure is now much less than it used to be, it is not so low as it ought to be, or as the necessities of the industry demand. These various sources of expense are the principal drawbacks which are keeping profits low, and into these, and any others that may present themselves, we now purpose looking.

The first is the expense of European management. This we hold to be illusory, in fact, we look on it as a source of profit. A correspondence has lately been going on in the Calcutta daily papers on this point, and as usual, various views are entertained, some affirming that European management handicaps tea as compared with the Chinese custom; this we hold to be wrong, and we would strongly recommend those who think so, to try a cheap Bengalee manager, for say three years. We imagine he would, ere that period had been reached, have reverted to his

European management. Doubtless Rs. 400 appears a large sum in the monthly pay sheet as compared with an educated native's pay, say Rs. 100, but what of the savings the European effects in a hundred different ways, which will at once occur to sagacious minds, and need not be more particularly noticed here, we may therefore dismiss this so-called drawback.

We will now look into the subject of Calcutta expenses,—and this head may be divided into several items. We will take them up *seriatim*.

Directors' Fees.—This item we hold as entirely unnecessary, on the garden there is the European manager, who is or ought to be trusted, and left very much to the exercise of his own discretion, entirely so as regards garden and factory details, while in Calcutta—or London—are the managing agents or secretaries, who should attend to all financial and commercial details. If the directors are necessary, then the managing agents are not, and *vice versa*. To a certain extent we hold that neither are necessary; however, we are now looking at the item of directors' fees. If the agents are able to look after the company's interests; what is the use of directors? If they are not able, for what are they paid so highly? It may be said that the directors are appointed by the shareholders, to attend to their interests. This implies either that the agents are not to be trusted, or are incapable of attending to the shareholders' interests; in either case we ask why we have agents? Doubtless an agent of some sort ought to be appointed, and he should be such an agent as would make the office of director a sinecure. We shall enquire into this in our next number when we go further into the subject. The director costs the company a large sum of money. In a daily contemporary, a letter appeared last month stating that it was customary at a directors' meeting for the directors present to toss for an absent brother's fee. We are unwilling to believe this, while we hold that directors entail unnecessary expense on a company, we have not abandoned our belief that they are gentlemen. In the report of a Limited Co. lying before us, and whose office is in London, we find the sum of about £600 charged as directors' fees. Now from the report, we find that there are five directors, including the chairman, and each man, therefore, drew from the company the sum of £120, which, had it been remitted to India at 1s. 8d. per rupee, would have yielded Rs. 1,440, almost sufficient to pay an assistant's salary; and what benefit did this direction confer on the company compared with what would have been derived from the services of an extra assistant. We will look at it from two other points of view. This sum of £600 was equal to an absorption of ·731 or nearly three-quarters per cent. on the capital of the company. Will any one assert that the advice of these five men who were most probably ignorant of tea practically, was necessary for the company's welfare.

PERSONAL SUPERVISION NECESSARY.

IN reply to AN INTERESTED PARTY in your's of August, as to what tea will do on the Neilgherries; whilst I agree with you, that lower elevations may give larger pickings, they will secure more fever and misery, with incapacity for efficient supervision.

A short time ago I was very much struck with an advertisement offering an estate for sale, promising the buyer 20 or 30 per cent. if he managed the property himself. No mention was made as to the practical qualifications of the buyer as a planter. Residence was insisted on as the condition necessary.

Whilst on the hills, within the last twelve months, and living in a Government rest-house not 20 miles from Ooty, two travellers arrived and occupied an adjoining room. In the partition wall there was a thin door with venetians. Mr. Alpha commenced the conversation in a loud tone, urging on Mr. Omega the advantages of purchasing a share of an estate *with the management*. A very favourable report was given to Mr. Omega of the various advantages such a position offered. That gentleman excused himself by stating some of his circumstances, and the imprudence of investing any further at present. Mr. Alpha then lowered his voice, but in the sentences that passed "coolies," "maistries" were distinct and audible, with some great advantages to be gained through them or their agency. At the end of these detailed advantages, Mr. Omega broke into a loud laugh, and very much to his credit, as far as I could gather, he declared he would have nothing to do with such practices. Mr. Alpha had evidently misjudged his man, and excused himself by declaring it was the common practice, sanctioned by custom, and, in fact, that they *all did it*. The impression left on my mind was, that the check roll and advances to maistries were the two means by which advantages could be gained sufficient to recommend the investment. The travellers having finished their bottle of beer rode away, one towards Ooty, the other in an opposite direction, leaving me to philosophise on they "*all do it*." I quite believe they *do not all do it*. But it is enough to account for tea *not always paying*, if *any do it*. Many years ago I remember an ex-officer from the Bombay side being put in charge of a coffee estate in Ceylon. In a most marvellous way he never had an absent cooly. All the men on the roll turned out daily, through each succeeding month. This estate did not pay.

Tea on the Neilgherries is very much like all other pursuits. Soil and climate must be backed by an active intelligent supervision, with honesty of purpose and some practical experience. I do not know any pursuit I should enjoy more than tea and cinchona planting on the Neilgherries; but I, like many others, am a slave to circumstances. The climate is nearly perfect. There is healthy occupation for every hour of the day, a good appetite, and sound rest at night. That tea and cinchona will pay handsomely on the Neilgherries I have no manner of doubt, if the master knows what to do, and does it.

A hint as to my own late experience there may be of service to AN INTERESTED PARTY. I bought land that was well adapted to my purpose. The soil was all there; an analytical chemist had reported well on similar soil. The only question with me was, whether it was not what agriculturists call "deaf"—that is, having all the powers necessary for plant food, but in a latent state, requiring good honest working, with a dash of lime or sulphate of ammonia. As soon as I had purchased the land, I set to work for a practical test. I had eight pits dug, 18 inches by 18 inches, and the soil well pulverized. I looked to this myself, but I had to leave before I could get the eight tea plants from a neighbour. The taking up the plants and the planting I intrusted to the party in charge. I gave the most minute directions as to taking them up carefully, and to be sure that the top roots should not be injured, or turned in the planting. In due course the work was done, and reported as done according to my orders. Some four months after, I visited the estate, and found the plants looking healthy; but as if they would be the better for a more generous diet. With a sharp pointed stick, I worked in a handfully of spontaneously slaked lime round each plant. I watched the result for a month; the plants made leaf, but not vigorously. I obtained reports from the superintendent in charge some 3 months later on; they were not what I had a right to expect, so I ordered two plants to be taken up carefully and sent to me by the quickest route. I was prepared with microscope and such other means as I had at my disposal to examine each plant minutely, but as soon as the parcel was open, "the cat was out of the bag." The top root of the largest plant, 24½ inches above ground, was broken clean off, and barely had 7 inches below the soil. The top root of the smaller plant, 22½ inches above gound, had also been broken off and turned round at the extremity, giving in all 4½ inches below the soil. Under such circumstances, the wonder is that the plants struggled on for 8 or 9 months, making growth and leaf as well as they did. In thousands of such cases, climate, soil, and manure are unjustly blamed. One might as well amputate babies legs at their knee-joints, and cut away half their stomachs, and then wonder that they do not thrive. My impression is that one-half the coffee and tea estates are ruined at the onset by injury to the top roots, and slovenly planting. On young estates, let proprietors dig up carefully on each visit a dozen plants out of each newly-planted plot and test matters for themselves. With a reserve of young plants in baskets to fill up such vacancies, no injury would be done to the estate, and the superintendent would learn that the proprietor, though an absentee, can get at facts.

My candid advice to AN INTERESTED PARTY is to stick to his estate if he can reside on it. If he cannot, he must be guided by circumstances, and the sort of man he can get to take his place.

C. J. B.

Tuticorin, August 1879.

WE received the above communication from an esteemed correspondent, and cordially commend his advice to planters of tea, coffee or cinchona.—ED., *I. A.*

COFFEE.

THE industry as a speculation is not in a good way. While many properties in India and Ceylon are really valuable and well managed, it would seem that there are many evils to be got rid of, ere coffee scrip takes its proper place in the share list. The late meeting of the Ceylon Company, Ld., is a glaring instance, although in this case, coffee is not so much to blame as sugar.

PROSPECTS OF CEYLON COFFEE.

THE following remarks which appear in a recent number of the *Pall Mall Gazette* relative to the coffee industry in Ceylon, will interest many of our readers, especially as they emanate from the pen of one who signs himself A PROPRIETOR. "That coffee enterprise in Ceylon is safe and sound as any agricultural enterprise can be, no merchant or planter of experience can doubt. I admit that of late years our crops have been greatly reduced, and no doubt leaf disease has done its share to bring about this state of things, but not leaf disease alone. Abnormal seasons and restricted cultivation, or, in many cases, the absence of any cultivation have contributed. The last will bring disaster under any condition of the seasons—leaf disease or no leaf disease; and so it has been with all or nearly all upon whom disaster has fallen in Ceylon. I have for nearly twenty years had the control of a large number of estates, and am still a proprietor of upwards of a thousand acres of coffee, and I have never known a properly managed property, well cultivated, bring disaster to its owner. On the contrary, I know that no better or safer investments can be entered into. Let me give you the result in actual figures of the working of an estate which has come under my knowledge within the last four years. The property in question consists of 600 acres of coffee, and 100 acres, of grass, supporting about 200 head of cattle, all for manuring purpose. The crops secured and put in the Colombo market were for three years as follows:—1876, 20,600 bushels on an expenditure of £6,283; 1877, 21,355 bushels on an expenditure of £7,192; 1878, 20,265 bushels on an expenditure of £7,759; total 62,220 bushels on an expenditure of £21,239. The average value per bushel in Colombo was 21*s*. equal to £65,330, or a gross profit of £44,000 on 600 acres in three years. The only deduction to be made from this would be interest on the capital invested—say, £48,000, at which price I believe the property was offered for sale in 1876. These results were obtained simply by good management and cultivation. The property is not what a planter would describe as a first-class estate, and it has no advantages either as regards soil, district, or climate; indeed, I know scores of estates more favoured in every respect, and from which equally good, if not, better, results might be obtained under similar treatment. Let this example suffice for the present. What Ceylon wants is money at a reasonable rate of interest, an extension of the present railways by which planters could procure fertilising manures at a moderate rate of transport, and these obtained, you would hear no more of disasters among coffee proprietors. The cost of transport for artificial manures, such as bone dust, say seventy miles by rail and thirty by road, is at present about £4 10*s*. per ton, or about five times as much as its freight from Australia, say 4,000 miles.—*Ceylon Times.*

THE WANTS OF THE WYNAAD.

THE letter from the Honorary Secretary of the Wynaad Planters' Association to the Government of India, must be regarded in the light of an indictment against the local Government. It is difficult to understand why the Madras Government should voluntarily lay itself open to the serious charges which are made in this letter. Coffee is grown almost exclusively in this Presidency, and the value of the export of the article in the five years ended 1877-8, as given in Mr. O'Connor's review of the Trade of India, is as follows:—

Years.		Cwts.		Rs.
1873-4	...	364,420	...	1,49,14,109
1874-5	...	311,831	...	1,30,53,346
1875-6	...	371,986	...	1,62,70,267
1876-7	...	302,489	...	1,34,58,217
1877-8	...	297,327	...	1,33,84,992

In the Wynaad alone the area of coffee exceeds 45,000 acres; 100,000 labourers are employed in its cultivation; and the value of the produce exceeds £1,000,000. Surely these facts are very significant of the importance of coffee-cultivation in connection with the development of the resources of the Presidency, and the welfare of its inhabitants. Let it be borne in mind that in addition to the Wynaad, there are large areas of land, either already planted or available for coffee, in Mysore, Coorg, Travancore, and on the Shevaroy and Annamally Hills; and that only a fraction of the land that will probably prove suitable for coffee, tea, and cinchona cultivation has, as yet, been taken up by planters. We may then form some idea of the proportions which the planting industries in Southern India may assume, if the British and Native administrations will only do as much for the encouragement of planters here as is done in Ceylon. The conditions of climate and soil in the hill districts of Southern India are, as might be expected, very like what they are in Ceylon, and there seems no good reason why coffee-planting should not be carried on as successfully and extensively with us, as it is in the little island on the other side of Paumben Channel. Has it never occurred to the Indian Government that, with a liberal encouragement to European capitalists, exports of tea and coffee might be increased to many millions sterling, while ten times the number of coolies who now make their way to the Wynaad might find profitable employment for their labour. There is no man who understands anything about the capabilities of our hill districts who will not say that there is room for an enormous development of tea and coffee cultivation. The planting industry is, in fact, as yet only in its infancy. It has not grown so rapidly as it would have done, because the planters have had difficulties to contend with which the Government should have made it their business to remove. If the Government are persuaded that it is a good thing for the country generally to have the hill districts opened up by European capitalists, then steps should have been taken to give the capitalists facilities for buying or leasing land, for obtaining labour, and for carrying the produce of the land to market. Under ordinary circumstances, a prudent landlord will never hesitate to aid a tenant who undertakes to improve an estate, and, as a matter of fact, this is the position which many of the planters occupy in regard to the Government. The Madras Government, however, on their part, have never yet recognised the fact, that coffee planting is a benefit to the country, or that the planters ought to be encouraged as tenants who are adding permanent improvements to the national estate.

The chief difficulty our planters have had to contend with is in controlling their labour. In Ceylon, which has been sufficiently successful in developing coffee cultivation to warrant us in taking a leaf from her book, the Government some years ago passed a Labour Ordinance by which all the relations between the planter and his coolies were regulated according to law. By all accounts the Ordinance has worked very well. If the labour had been badly treated under this Ordinance, we should have heard of it long ago, as the labour in Ceylon is drawn from our Tamil districts. The Ordinance has stood the test of experience, and the fact remains that the Ceylon planters find no difficulty in drawing all the necessary supplies of labour from Southern India. This fact is conclusive as to the successful working of the Labour Ordinance. It is simply amazing, with this fact before them, that the Madras Government has gone on year after year persistently refusing to pass a similar Ordinance for the benefit of the planters in the Wynaad. For twenty-five years have the planters been urging on successive Madras Governments "the various disadvantages under which they have laboured in the absence of efficient law controlling the relations between planters and the labourers they employed." "Our coolies run away," cry the planters. "Ah, you don't give them wages enough," answer the Madras Government. "But they have run away with our advances," return the planters. "Catch them and we will punish them," reply the Government, knowing full well that the delinquents have disappeared over the Mysore border. This is no exaggeration of the kind of arguments that have been used by the planters and Government for the last quarter of a century. Only quite recently we heard of a member of Council shelving the Wynaad difficulty by arguing that it was a question of climate and wages. 'The climate is distasteful to imported labour: therefore you must offer greater inducements. You must manage to make your terms on the whole more attractive than Ceylon or Mauritius.' The planters reply to this specious argument, is that it is not the wage which is the cause of the difficulty, but the want of a legal guarantee that the labourer will perform his part of the contract. Surely the time has arrived when the demands put forward by the planters should receive serious consideration. The mistake the Madras Government have made from the beginning is in ignoring the results of the working of Labour Ordinances in Ceylon and Mauritius, where, in both instances, it is the Tamil labourers who are brought under the influence of these laws. If Ramasawmy has no objection to be bound by the provisions of a special labour law in Ceylon and Mauritius, why should he do so in the Madras Presidency? If the Madras Government are so squeamish about infringing free trade principles, it is hardly consistent in them to allow so many thousands of labourers to leave the shores of this Presidency every year to labour in distant countries, where the relations between master and servant are regulated by law. The mere fact that it has been found advantageous in Ceylon and Mauritius to introduce Labour Ordinances, should go far to convince the Madras Government of the necessity of such an Ordinance in territory under their own jurisdiction. Had the Ordinance failed in Ceylon, there would be some reason in resisting its introduction here. But when we find, as we certainly do, the Ordinance working to the advantage of, not only the planters, bu of the Government and the labourers themselves, it is simply absur to bring forward the old arguments against it which are discredite by facts that are patent to everybody. If the Madras Governmen would only inquire carefully into the causes of Ceylon's prosperity, the would learn a lesson in the administration of the planting districts o Southern India, which might in a few years prove of enormous benefi to the country. Mr. Logan, the Collector of Malabar, seems to have th confidence of the planters, and to understand their requirements. Wh not let Mr. Logan then be commissioned to go over to Ceylon, an ascertain what features in the Ceylon system of administration coul be applied with advantage to the planting districts in this Presidency The Madras Government could not possibly go wrong if they too steps to ensure the same degree of prosperity for the plantin industries in Southern India that has already been obtained in Ceylon.

If we wanted any further instance of the characteristic indifferenc of the Government to the extension of coffee cultivation, it would b found in that portion of the Association's letter which refers to th application of the Coffee Stealing Act of 1878. We do not know wh is responsible for the limitation of the Act to Wynaad itself; but th obvious remark in Mr. Yonge's letter that "every dishonest dealer h been emboldened by the fact that he is free to operate on the coffee a soon as it has passed the ridge of the ghauts," is not very complimentar to the intelligence of our legislators; nor does it say much for thei scrutiny of the Act while it was passing through the Legislati Council.—*Madras Mail.*

THE PLANTERS' MEMORIAL.

THE planters of the Wynaad have a grievance which they have laid before the Government of India, in a statement made by the Honorary Secretary of their Association, written in such a manly and straightforward manner as ought to carry conviction, and claim the attention and consideration of the Viceroy in Council.

For the last twenty years the subjects of this memorial have been brought to the notice of the Madras Government without avail; therefore it is of necessity sent further, with the avowed intention, unless redress is obtained, of laying the case at the foot of the Throne; and the planters have shown by the energy and dogged persistency with which they have maintained their case, in face of the rebuffs of Government, the sneers of haughty officials, and other obstacles to be overcome, that they are not the class of men to abate one iota of their exertions, whilst a single chance remains untried.

The coffee industry was scarcely known in Southern India five-and-twenty years ago. Yet at the present moment it exports upwards of one million sterling's worth of produce yearly, and this is extracted from land which, before this industry was introduced, was utterly worthless and unprofitable to Government, or such native proprietors as possessed any, was a hotbed of malarious fever, and the abode only of the tiger and elephant, and every description of beast of prey.

There is scarcely another instance so remarkable in which the emigrant Englishman has shown his indomitable will to overcome difficulties, unaided by any, or anything but his own determined strength and courage, although obstructed and restricted by the Government.

The cultivation of coffee commenced before the mutiny, and the settlers were, therefore, as was usual in those days, looked upon as interlopers by the Company's Civil Servants, and received very little encouragement when her Majesty the Queen's rule was proclaimed. It was naturally expected that the same protection and assistance, as was afforded in other colonies, would be obtained in India, and gentlemen of birth and education joined the enterprise in the Wynaad, bringing with them what was so much required, English capital and English example; but the old system continued to prevail. Why does Government still continue to pursue a policy so detrimental to its own interests, and to the interests of the native population?

It has been admitted by politicians of every denomination, that three things are necessary for India;—the circulation of capital, new industries, and the employment of the population.

The planters have done all this and more; millions of English capital have been invested in cultivation; coffee has become a great support to the revenue of Madras; and 100,000 natives are employed in a business which was never thought of before; and above all, their example and intercourse with the natives, has induced them in a great measure to follow the same pursuits, has enlightened their ideas, and ensured their loyalty and devotion to the Crown. The planters' greatest difficulty has been the irregularity of the labour market, and insufficiency of control over their labourers, and they have again and again urged the Madras Government for an enactment which shall be as beneficial to the employed as to the employer, but have been again and again refused; hence the present appeal to the Supreme Government.

The value of this industry will be seen at a glance, and its threatened decline, in consequence of that want of sympathy and encouragement which is always more or less necessary for the well-being of every such extended undertaking.

The amount of coffee exported :—

		Rs.
In 1875-76 was 371,986 cwts. valued at	...	1 62,70,267
In 1877-78 „ 297,327 „ „	...	1,33,84,992

and the area of cultivation is upwards of 45,800 acres. There are no new openings in prospective; no new-comers; several parties with their money in the bank, who were waiting to purchase land and invest, when Government shall decide on a protective Labour Act—have drawn out their money and gone to Australia or New Zealand, and one capitalist, who had wasted two years, left last month in disgust.

There are ten times the number of available acres still untouched and suitable for coffee, tea and cinchona, which would be occupied in a very short time, if those ready to invest could be brought to believe in the sufficiency of labour, which can only be insured by the aid of the Government.

Extension of cultivation means increase to the revenue, which at this time is of the utmost importance; and when that derived from this source can be easily doubled, the country benefited, and the poorer classes usefully employed, without any increased expenditure to Government, it is reasonable to hope that the prayer will be granted, and we shall look with much interest for the answer to the Planters' memorial.

W.

COFFEE AND TEA.

THE following is from the *Globe* :—"According to the 'Statistical Abstract for the United Kingdom, 1878,' the popularity of tea as a beverage increases steadily in the United Kingdom, while the demand for coffee remains stationary. In 1863, the quantity of imported tea retained for home consumption was 758,929 cwts., while in 1877 it was very nearly double, the exact amount being 1,340,311 cwts. On the other hand, coffee fell away during the same period from 292,528 cwts. to 288,263 cwts., a considerable diminution when the increase of the population is taken into account. Nor can the decrease be explained by the theory of a larger admixture of chicory, for the consumption of that article remained almost as stationary as that of coffee. It is a curious thing that a beverage which presents so many advantages for the working classes has not come into wider use. A mild stimulant, a heating agency, and possessing great sustaining power, coffee would seem to be the very thing for those who have to labour for long hours in the open air; but use and wont are on the side of tea, it appears, as strongly as ever, and even the rising generation must yield to their power, or we should see some evidence of an increased consumption of coffee concurrently with the enormous development of tea imports. Perhaps the new movement for coffee taverns may do something in this direction, by unfolding to the working classes the virtues of the berry which they have so long neglected. True, there have been early coffee stalls in the streets for many years past, but the article vended at these establishments is not exactly calculated to create widespread popularity. The curious decoction may possibly be sustaining and heat-giving; so far as thickness goes it leaves nothing to be desired. But the flavour is distinctly nauseous, and the sediment so plentiful that, as a workman was once heard to remark, 'one gets meat and drink at the same time.' In former times, it was not very easy to obtain a good description of berry except at a high price. Now, however, Ceylon, Costa Rica, and Southern Madras produce very fine qualities, which can be bought at much lower rates than the so-called 'Mocha,' and are quite, if any, inferior to that standard of excellence."

DISTRIBUTION OF OUR COFFEE CROP.

TO present date the distribution of our coffee crop stands as under in cwts. :—

	Plantation.	Native.	Total.
To United Kingdom	662,954	8,648	671,602
„ Marseilles	10,379	2,808	13,187
„ Genoa	251	500	751
„ Venice	4,425	8,196	12,621
„ Trieste	44,703	1,851	46,554
„ Other Continental Ports ...	2,872	10,000	12,872
„ Mauritius	49	30	79
„ India and Eastward	1,716	7,765	9,481
„ Australia	4,564	903	5,467
„ America	2,093	6,197	8,290
Total Exports from 1st October 1878 to 8th August 1879	734,006	46,898	780,904

—*Ceylon Times.*

COFFEE IN FIJI.

COFFEE planting in Fiji is now a different matter from what it was when the Ceylon planter bought in Melbourne for a mere song a large tract of forest land. Desiring to see his property, he made his way to Sydney with the intention of shipping for Fiji, but proceeded no further, having got an authentic account while there that two Europeans had been eaten on his place a short time before. Now, since the British Government has taken over that group of islands, life and property is more secure; and the presence of several Ceylon planters has pushed the coffee enterprise to the front. I give the following quotation from an interesting letter just received here from Fiji. The writer of the letter has some considerable property in the group,—cocoanut, and sugar plantations—but of his coffee he writes, "I can reckon on 10 cwt. to the acre, seeing that from the first crop of coffee (of any size) grown in Fiji, a crop of 5 cwt. has just been gathered from trees little more than two years old. Several gentlemen from Ceylon have begun clearing here. They are delighted with the country, and say that the rainfall and temperature are exactly suitable, and soil much better than Ceylon." Enquiries, I understand, have been made here for pulpers and other coffee-machinery, and the difficulty of obtaining employment now in Ceylon will probably induce some of our unemployed force to try their luck in Fiji.—*Ceylon Cor. to the Madras Times.*

LIBERIAN COFFEE.

IS now cultivated pretty extensively in the warmer parts of the island. This species, though by no means exempt from the attacks of the *Hemileia* does not appear at present to suffer so seriously from it as does the ordinary coffee, and it is believed that the cultivation of the Liberian coffee will prove to be a profitable one, and especially so if means can be discovered to check the leaf disease in good time. The few plants we have of it under cultivation in this garden, produce fruit copiously and nearly continuously. The beverage it furnishes is very highly flavoured, and to those who have tasted it, is generally pronounced agreeable. This bids fair to be an excellent substitute to the villagers for their own native coffee, so much of which unfortunately has nearly died out. With the sanction of Government, a considerable number of plants and seeds of the Liberian coffee have been distributed free of charge, to the native villages.

A hope has been expressed that some species or varieties of coffee, grown in the West Indies, may prove able to escape the attacks of the *Hemileia*, and it has been considered very desirable that the subject be experimentally investigated in the gardens of this establishment and elsewhere, by the aid of specimens which his Excellency has kindly offered to procure from the authorities of the respective countries where these coffees are now largely and successfully cultivated.—*Report on Botanic Gardens, Colombo.*

COFFEE IN BRAZIL.

(The Produce Markets' Review.)

THE following is from the report of Mr. Consul Austin, on the trade of Rio de Janeiro, for 1877: "Notwithstanding that from its first start in 1800 it has been cultivated on the rudest and most primitive system, the production of coffee attained its highest point in 1856. Taking as a standard of the rate of progress from that period down, the average of every ten years, it will be found that since 1856 there has been no relatively steady advance. From that date to the present the only notable feature in this article has been the fluctuations, not by any means great, between one crop and another, and these are easily explained. There are, doubtless, various causes for this sudden paralisation and stagnation, but the primary cause of all is the labour question. The halt followed immediately on the staunching of that vast element of forced labour, under which that rapid progress was achieved. That great force having been dispensed with, and no substitute obtained, is, after all, the real and most conclusive solution of the great collapse in Brazil of commercial progress and prosperity.

"The total exportation annually from Brazil ove[illegible]rty-six years, was as follows:—

Year.	Bags.	Year.	Bags.	Year.	Bags.
1832 ...	562,915	1848 ...	2,098,866	1863 ...	1,652,259
1833 ...	687,136	1849 ...	1,786,744	1864 ...	1,811,922
1834 ...	686,462	1850 ...	1,644,648	1865 ...	3,197,464
1835 ...	792,572	1851 ...	2,498,995	1866 ...	2,368,635
1836 ...	859,706	1852 ...	2,883,839	1867 ...	3,255,980
1837 ...	748,185	1853 ...	2,005,441	1868 ...	2,772,929
1838 ...	934,561	1854 ...	2,434,084	1869 ...	3,130,789
1839 ...	1,088,630	1855 ...	2,858,107	1870 ...	2,704,742
1840 ...	1,307,921	1856 ...	2,570,016	1871 ...	2,881,626
1841 ...	1,258,892	1857 ...	2,570,480	1872 ...	2,460,351
1842 ...	1,410,984	1858 ...	2,230,759	1873 ...	2,433,709
1843 ...	1,426,926	1859 ...	2,485,384	1874 ...	2,678,281
1844 ...	1,509,317	1860 ...	2,825,157	1875 ...	3,152,296
1845 ...	1,468,767	1861 ...	2,538,584	1876 ...	2,765,922
1846 ...	1,849,888	1862 ...	2,819,656	1877 ...	2,845,114
1847 ...	2,009,348				

A NEW COFFEE ADULTERANT.

IN the recent annual report of the principal of the Inland Revenue Laboratory, some observations were made on a new method of adulterating coffee, which has lately been detected. The adulterant in question consists of date stones, which, after being roasted and ground, form such an imitation of coffee as would, when mixed with the genuine article, easily deceive the consumer. Information received by the Inland Revenue authorities at Somerset House from a supervisor at Liverpool, has led to an early discovery and suppression by the Somerset House authorities of this new mode of adulteration. Many tons of date stones (a refuse from the manufacture of spirits at a distillery in Liverpool, and which had hitherto been considered useless) were being bought by a foreigner to be forwarded to Manchester, and supposed to be intended as an adulterant of coffee. It was subsequently ascertained that a manufactory had been established in that city for the preparation of "Mellitine coffee," a mixture of coffee, chicory, and date stones. Of this "Mellitine coffee," and of the prepared date stones several tons had been seised. The early detection of this adulterant, has prevented the consumption of any large quantity of the "coffee."

CINCHONA.

THE quantity of bark taken from the British Sikkim plantations for the year 1878-9 was principally limited to the requirements of the febrifuge factory, and amounted to 261,659 lbs., and owing to the dryness of the season, little was done towards extensions, only 121 acres having been planted out. The number of plants now in bearing are 1,735,396, with a reserve of 270,000 seedlings.

Now that this new industry is an assured success, we think the Government ought to sell the entire property. The functions of Government lead it to pave the way for such industries, by experimenting, often at such a cost as frequently prevents private enterprise making the attempt, but when success has been thoroughly assured, we think the time has come for Government to make over the plantations to a private company, as was done in tea in earlier days.

The Government Quinologist's report for the year 1878-79 is also to hand, and we find satisfactory proof of progress, the quantity made being 1,845lbs. in excess of that of the previous year. This increase of manufacture was warranted by a steadily increasing sale of the febrifuge. There are, however, one or two things in the report to which we are inclined to object. For instance, the value of the bark is debited at its actual cost to Government; this may be all right so far as the Government is concerned, but it places the plantation at a disadvantage. The nett cost of the bark used was Rs. 0 2-11·9 per lb., and at this rate it is debited to the cost of making. The quantity used was 265,120 lbs., the value of which at that price is Rs. 49,543-4-2, and the other charges of manufacturing, Rs. 26,916-8-9. The total cost was therefore Rs. 76,459-12-11; as the quantity made was 7,007 lb. the cost per lb. was Rs. 10-14-7·088. Now had this bark been sold in the usual way, it would have realized Rs. 2-4-7 per lb., basing the value on the account sales on page 249, with exchange at 1·8*d.*, and this we say is the price at which it should be valued in the account. Let us see how this would show:—

To manufacturing charges ...	... Rs. 26,916	8	9
" Value 265,120lbs. bark at Rs. 2-4-7	... 6,06,185	13	4
Total cost	6,33,102	6	1

Cost per lb. Rs. 90-5-7·746. At this rate it could not well be sold under Rs. 6 per oz., and if, as is asserted by some who use it, it takes a three-fold quantity to have the same effect as sulphate of quinine, we would be inclined to doubt the economy supposed to follow its use, and we would doubt still more strongly the propriety of the Government continuing its manufacture. If it be made, and issued gratuitously or at a cheap rate where fevers are rampant, we can understand the process, as a question of policy, but as a commercial transaction, it would undoubtedly pay much better, were the bark to be shipped to London for sale in the usual way.

IN October last the Madras Government forwarded to the Secretary of State for India forty-five samples of bark grown on the Neilgherries, with a view to having them analysed to see which gave the best results. The analyst's report is to hand, and is very exhaustive. Several varieties are apparently not worth cultivating, while others give very favorable results. Two in particular stand out as most profitable classes to grow, the outturn from them being as follows.

	C. Calisaya per cent.	*C. Augustifolia.* per cent.
Quinine	4·92	4·86
Quinidine	...	·17
Cinchonidine	1·56	1·88
Cinchonine	·62	·26
Amorphous Alkaloid	·70	·30
Total ...	7·80	7·47

These are certainly the highest results shewn in the report, but they serve to indicate what may be done. It would seem wise to confine cultivation very much to these two *jâts*, provided there be nothing in the constitution of the plants to make it unadvisable to grow them.

As a further proof of what we have suggested above, as to the absurdity of only charging the actual cost of production for the bark used in the manufacture of the Indian febrifuge, *viz.*, about three annas per lb. We have just seen the account sales of a parcel of bark sent to London by the Madras Government early this year. The parcel consisted of 215 bales averaging 98lb. each, making a total of 21,070lbs. The gross amount realized was £7,330-17-11, from which charge to the amount of £452-17-4 fall to be deducted, leaving nett £6,878-0-7. The account sales is dated 12th April 1879, and at that date exchange on demand stood at 1-7¼*d.* per rupee. This presupposes that the sum of Rs. 85,752-8-1 would be remitted to Madras, the difference being gain by exchange. If the sum was, as is most likely, paid to the Secretary of State, it saved *that* amount to the Government in remittances. This was equal to Rs. 4-1-1½ per lb., and at this rate the bark used at the factory should be valued.

TOBACCO.

We read that the tobacco manufacture at Pusah in Behar has not yet passed beyond the stage of experiment; but Messrs. Begg, Sutherland and Company are persevering with the enterprise, and the results so far are sufficiently encouraging. From 200 acres 150,000 lbs. of tobacco-leaf were realized, samples of which were shipped to England, and realized fair prices.—*Mirror.*

HOEING TOBACCO.

Hoeing tobacco, by some growers, is a very slow and tedious work. It should be done very rapidly. I can see no reason why it is necessary to cut and clean away all soil that is in contact with the plant to the depth of from one-half to an inch, and then pulling up new and fresh soil around the plant. Many farmers do this always. Is it because they suppose that the displaced soil has become exhausted? No experienced person can think so for a moment. Why, then, do they persist in this (as it seems to me) foolish operation? Is it because the earth has become crusted and hard? This may be so; but would not throwing a small portion of fresh earth upon the surface of the hill have the same effect, and without injury to the plant?

I am of the opinion that this deep cutting with the hoe near the plant is all wrong; in common or ordinary soils, the soil is loose enough to admit the air and heat of the sun. What more is wanting? I think it is well to hoe tobacco as soon as it is evident that the roots have secured a foothold, and the plant shows a tendency to grow a little. But hoe very lightly, and be careful not to run the cultivator too close to the row; then follow with the hoe, cutting up the weeds if any have started. And if the land has been fitted a great while, the weeds will show themselves.

When they are near the plant, if not easily removed with the corner of the hoe, stoop and remove them with your fingers, but by no means endanger the breaking of the nearly started rootlets. These little fibrous roots are exceedingly tender and easily broken, and a day or two of valuable time is lost for the growth of the plant to get back where it was before it was hoed. I have seen men so intent upon removing the soil, and so close around the plant that it would be loose, or a little ball of compressed sod in where the roots were imprisoned would fall over, and the hoer would have to stop and hold it in position with one hand whilst he braced it up with some fresh soil. I am of the opinion that it is well to go over the tobacco rapidly and often, at least four times before the plants have attained such size as to be at all troublesome in hoeing or cultivating. And after that, if weeds start, go through and remove them. And all this time be sure to have the land well stocked. If a plant is missing, see to it that another is set in its place.—*American Cultivator.*

CULTIVATION AND CURING OF TOBACCO.

The cultivation of tobacco is most extensively carried on in the United States of North America. It requires considerable heat to come to perfection, but with care and attention, and by treating it as an exotic, it may be very successfully cultivated in much colder climates. The least frost injures it, but this is the case with many plants which are nevertheless successfully cultivated in the northern part of Europe.

The seeds of the tobacco plant must be sown in a prepared seed-bed, and be carefully protected from the least frost, for which purpose straw and fern are used, as is done by the market gardeners who raise early culinary vegetables. When once the dangers of spring frosts are over, they may be safely transplanted, and if the ground has been duly prepared, they will arrive at maturity before the frosts of autumn, as is the case with potatoes, buck-wheat, and many other plants which are natives of warmer climates.

To accelerate the growth of the tobacco plant, the ground should have been deeply trenched and highly impregnated with manure for some time before, for fresh dung, especially that of horses, would impart a rank, disagreeable flavour to the leaf. It is, therefore, by a preparatory course of high cultivation, and by bringing the soil to the state of a rich garden mould, that tobacco may be cultivated without much fear of failure. There can be no doubt that if it were not for the fiscal restrictions arising from duties imposed upon tobacco by almost every Government, the cultivation of it would be a great resource to native industry, especially on a small scale by cottage gardeners. In Holland, of which the climate differs little from that of Great Britain, tobacco is cultivated to a very great extent, even in very poor soils, by great attention to manuring, and by accelerating the growth of the plant. The seed is sown in a well-prepared seed-bed in March, and protected by mats laid over hoops as long as the nights are cold and frosts are expected. The ground in which the tobacco is to be transplanted is laid in narrow beds, with intervals between them, which is dug out deeply as is done with asparagus beds, and richly manured with sheep's dung. These beds are 2 feet wide at top and 2 feet 6 inches at bottom, with sloping sides to keep the earth up; the intervals are only 6 or 8 inches, and serve not only as drains to keep the beds dry, but as paths from which the surface of the beds may be stirred and weeded. Two rows of plants about 8 inches high are planted at equal distances along the beds, the rows are 16 or 18 inches apart, and the plants at the same distance from each other. In warmer climates the plants are placed 3 feet apart, as there they grow to a much greater size and cover more ground. A moist day is chosen for transplanting, the plants are taken up carefully with a small spade or trowel without shaking the earth much from the roots, they are placed slanting in a shallow basket and thus carried to the prepared beds. They should be vigorous and have a stem 6 or 8 inches long. They are inserted into holes made by a proper instrument that the fibres of the roots and the adhering earth may be completely buried up to the bottom of the stem. Four or six leaves should be on the plant; if more, the lowest may be pinched off. If the ground was sufficiently moist and no great heat (or strong sunshine) withers the plants, they will scarcely appear to have suffered from the removal. Those which die, which must often be the case, are replaced by others left in the seed-bed for that purpose. Great attention must be paid to the beds all the time the tobacco is growing. Weeds must be carefully eradicated, and the earth repeatedly stirred between the plants with hoes or narrow spades to accelerate the growth. When the leaves acquire a certain size, the lower leaves should be pinched off, to increase the bulk of the upper, for the former are apt to wither before the latter have acquired their full growth.

A fine tobacco plant should have from eight to twelve large succulent leaves and a stem from 3 to 6 feet high. The top should then be pinched off to prevent its running and drawing the sap from the leaves; and every lateral shoot should be carefully pinched off as soon as it appears, to prevent branching. A few plants are left for seed, and of these the heads are allowed to shoot the full length.

The seeds are so small and so numerous on a plant that a few plants produce a sufficiency of seed for the next crop. The plantations of tobacco are continually examined, and every leaf injured by insect or otherwise is pulled off.

Tobacco takes about four months from the time of planting to come to perfection; that is, from May to September, when the leaves are gathered, before there is any danger from frost. One single white frost would spoil the whole crop and cause it to rot. As soon as the colour of the leaves becomes of a paler green, inclined to yellow, they are fit to be gathered. They then begin to droop and emit a stronger odour, and they feel rough and somewhat brittle to the touch. When the dew is evaporated and the sun shines the leaves may be most advantageously gathered, which is done by cutting down the plant close to the ground, or even a little under the surface. They are left on the ground to dry till the evening, taking care to turn them often that they may dry equally and more rapidly. They are housed before the evening dew falls, which would injure them, and laid up under cover in heaps to sweat during the night, and some mats are thrown over the heaps to keep in the heat. If they are very full of juice they are sometimes carried out again the next day to dry in the sun, but most commonly they are left to sweat for three or four days, and then moved and hung up to dry in sheds or buildings made for the purpose—like those in which paper is dried in the paper mills, which allow a thorough draught of air, but keep out the rain.

Every tobacco plantation has such buildings, proportioned to the extent of the cultivation. The floors are most commonly only the soil on which they stand, but it is much better if they are boarded, because on the earth the plants are apt to be soiled, which injures the quality of the tobacco.

In some places the leaves are now stripped off the stems and strung on pack-thread to hang them up to dry; in others, the whole plant is hung on pegs placed in rows at regular distances, and fixed on laths which are run across the building. All that is required is to place as many plants as possible without their being so near as to prevent the circulation of the air between them. When the plants are quite dry, they are removed in moist or foggy weather, for if the air is very dry the leaves would fall to dust; they are then laid in heaps on hurdles and covered over that they may sweat again, which they do but slowly. The heaps are carefully examined from time to time, to see that they do not heat too much, and according to the season and the nature of the plants, whether more or less filled with sap, they remain so a week or a fortnight. This part of the operation requires much attention and experience, for, whether they do not heat to the proper degree or too much in either case, the quality is impaired. An experienced tobacco grower will ascertain the proper degree of heat better with his hand than the ablest scientist could do with his thermometer. If the leaves were not stripped off at first, which is not the most common practice, they are taken off now, when the proper fermentation is completed, and sorted; those which grow on the top of the stem, in the middle, and at the bottom, are laid separately as being of different qualities. They are tied together in bundles of ten or twelve leaves and again dried carefully, when they are ranged in casks horizontally and pressed in by means of a round board, by lever or screw pressure, as soon as a certain quantity has been laid, the pressure is equal to that of several tons. This is essential to the safe transportation of the tobacco, and it is thus that the great bulk of it arrives from the places where its cultivation is most extensive, as in America.

The finest tobacco, however, is made into rolls, which from their shape are called carrots. The leaves are placed together by large handfuls, and wound very tightly round by strips of fibrous wood or strong grass at a time when the air is somewhat moist; they partially consolidate and require only to be rasped to make the finest and most genuine snuff, or rappee, as it is called. The snuffs commonly sold, however, are manufactured and prepared in a much more complicated manner.

The refuse stems of the tobacco are sometimes burned, but it is best to let them rot in the ground, where they are converted into good manure for the next crop after the tobacco; but this is quite a garden cultivation, as the tobacco recurs very soon on the same ground. The abundant manuring and deep trenching prevent any bad effects from this frequent occurrence.—J. C. Bowerman, Stoke Newington in *Country Gentleman's Magazine.*

SERICULTURE.

WE are glad to learn that silk cocoons raised at the Government Experimental Farm near Dehra in the N.-W. Provinces have succeeded in obtaining a better valuation than any other Indian cocoons now in the market. The advantage of sub-Himalayan silk culture is, that silkworm eggs can be preserved in the cold temperature of the Hills (where they are annually sent), until the most appropriate time for their being hatched arrives. The weak constitution of the worms produced by constant hatching in the warmer parts of India is thus avoided, while the birth of the young worms can be so timed as to allow them to be reared on a plentiful supply of young and succulent mulberry leaves. This occurs in the months of March, April and May. The result appears to be established that the cocoons produced under this system in the Doon are finer and in better condition than are the ordinary cocoons of Bengal. It is understood that a private firm is in treaty with the Department of Agriculture, N.-W. Provinces, for the transfer to them of the Government silk establishment and farm. Commercial success is certainly more probable if the enterprise is prosecuted by private energy. But great credit is due to Mr. Ross, the Superintendent of the Doon, for having proved to private enterprise that success is possible.

Now that the silk crops of Italy, France, and Spain is a decided failure, the Lyons silk-weavers have been much excited by the news of a discovery alleged to have been made by a German merchant, who proposes to coat flax fibres with a solution of silk, and it is stated that shares in the "company" have already been rushed to a high premium. It is said that fibre equal to silk can be produced at nine francs per kilogramme instead of 35, and if this is true, it will beat all that Manchester cotton loading can do. India is much interested in the report that jute can be treated in the same manner as flax, and "jute silk" is the product of the future.

The information wanted by our correspondent from Ranchee, has been kindly supplied by the writer of the article to which he refers. We give the gist of it, and trust it may be of service to him.

"Take a cocoon, boil it well till soft, in water in which is an "alkaline solvent, say lime, soda, potash, &c. Then manipulate "with a bundle of twigs or the fingers till a single thread begins "to run off freely. This will unwind continuously till the cover "(like fine tissue paper) immediately next to the chrysalis is "reached, when probably the thread will break off short. Your "correspondent has probably misunderstood me, because all single "cocoons can only yield one thread, and my allusion to it was "merely to point out that these single threads could be run off by "softening, instead of drawing them, as is done by the carding "process."

The *Japan Gazette* says reports are daily arriving from the silk districts of an alarming character. Disease of a kind not before known in Japan has made its appearance, attacking the worm in its most important stage, and arresting the completion of the cocoon, which, on examination, is found to be imperfect and valueless as silk. The weather, too, has been very much against the crop, and although there is said to be a larger number of persons engaged in this culture, the yield for this season will, it is confidently stated, be much below the average.

ON THE TUSSUR SILK OF INDIA.

(*Continued from page 290, No. 8.*)

THE latest report on tusser culture is one from Major Coussmaker, dated Jangaon, Ahmednagar, on the 10th of January of the present year. At Poonah he has established a breeding establishment, and has planted many young trees for feeding the worm. He says it thrives well on *Lagerstrœmia Indica*, an ornamental shrub fairly abundant in the cantonment of Poonah. He has changed his plan of feeding them on cut twigs brought to them in captivity, and allows them, carefully watched, to feed in the open air on the growing shrubs. This was an evident change for the better; the larvæ moulted in four to five days instead of five to eight days; they spun their cocoons in 28 to 35 days instead of from 40 to 50 days, and the moths emerged from the cocoons in 27 to 30 days, their eggs proving more fertile than under the former plan. He fed them also on *Carissa carandus*, and they throve still better on this; but the *Lagerstrœmia*, after having all its leaves eaten off, being cut off and repotted, was in thick leaf again in a fortnight, and was ever sprouting, whilst the *Carissa* did not sprout again after having been once denuded.

For the next season's experiments, Major Coussmaker has planted between 700 and 800 plants of the following species, *Lagerstrœmia Indica*, *Lagerstrœmia parviflora*, *Conocarpus latifolia*, *Carissa carandas*, *Zizyphus jujuba*, and *Pentaptera tomentosa*, so that we may look forward with a large degree of interest to the result of so practical an experiment to domesticate this interesting silk producer in the Deccan.

Captain Brooke says* :—

"In Chanda and Sunboolpoor, Central Provinces, when the cocoon crop is gathered, koshtas, a weaving caste, visit the villages and buy them from the rearers. They are then, as soon as practicable, boiled in a lye made from the ashes of jungni stalks, a plant grown for the oil expressed from its seed. This process effectually kills the chrysalis, at the same time dissolving the mucilage of the cocoon. The cocoons are then stored for use. The method of reeling is primitive in the extreme, and to its imperfections I solely attribute the scant attention this valuable and very beautiful silk has hitherto received. A description of the process is as follows :—The spinner, always a woman, sits on the ground; on her left is an earthen vessel, with a thickish rim, about 6 inches in diameter and 3 inches deep. The saucer is three parts filled with a mixture of potash and ashes, patted down to a level surface, and kept damp with water. Upon this the cocoons to be spun are placed, the outer portion, of inferior and nearly useless silk, having been first removed. The thread in ordinary use amongst the weavers is spun from seven cocoons; these are all placed at the same time in the earthen saucer, a filament is then taken up from each cocoon, and, being brought together, are rolled between the hand and left thigh of the spinner, which are kept damp by an acid solution of tamarind and water."

In Bengal, the cocoons are put into boiling water to kill the pupæ; in some districts, when intended for sale, they are put in boiling water and dried in the sun. In the Nizam's country, the cocoons are loaded with dhobee's earth and alkaline ashes to make the reel. In the Midnapore district, they are boiled in cow-dung and reeled by hand.

Captain Brooke says that, in Seonee, the pierced cocoons are wound, and that no koshtee rejects a cocoon simply because the moth has eaten its way through it. He has fallen into an error as to the moth's mode of exit from its cocoon. It separates the fibres with its legs and wing spine, and so creeps out. It has neither teeth nor mouth proper.

Each species of silkworm has two stores of silk, one on each side of the alimentary canal, and below its mouth it has two so-called spinnarets or orifices, through which the silk issues simultaneously in fine parallel filaments. As the silk is drawn out of the stores, the worm coats it with a varnish technically called gum, which contains a brownish yellow colouring matter.

The tusser worm, in spinning his cocoon, takes short sweeps of his head from side to side, depositing the silk very closely in parallel fibres as he does so. It has been thought that the worm twists the silk as it exudes it, but this is not the case. Besides the gum which coats the silk, the worm secretes at intervals a cementing fluid, which it kneads by an expanding motion of its body through the whole cocoon to consolidate and harden it. This cement gives to the cocoon its drab colour.

There is a striking peculiarity about the fibre of tusser silk. I have carefully and thoroughly examined it many times under the microscope, and find undoubtedly that the fibre is flat and not round, like mulberry silk.

There is no doubt that it is to this property that tusser silk owes its glassy or vitreous look, reflecting a little glare of light from the angle of incidence on its flat surface, whilst the mulberry silk fibre, being round, reflects the light equally in all directions.

By some this property is considered a drawback, but by the time the fibre has become modified, and the flatness diffused in the loom, I think the lustre of the cloth is enhanced by it.

This tape-like appearance gives the fibre this disadvantage, that it is less homogeneous than the round fibre of the mulberry silk, and I find an undoubted tendency in it to split up into smaller fibrets, thus causing the silk to swell out when subjected to severe dyeing processes, particularly the bleaching one of recent date, thus giving a substantial and important reason why its coloured cements should be removed by gentle action.

The fibrets have a distinct structure, upwards of twenty in number, and seem compactly laid together, showing the striated longitudinal appearance of the fibre under the microscope. I dare say it is this fibrous compound structure, absent, as you see, in the mulberry fibre, which is an element in its dye-resisting power. I found permanganate of potash to be the best agent to separate these fibrets.

The diameter, from edge to edge, of a single flat fibre of tusser silk from the outer part of the cocoon, averages 1/770th part of an inch, and from deeper in the substance of the cocoon 1/710th of an inch, but the external fibres are much more variable than the internal. The thickness from side to side is 1/1900th of an inch. The outside fibres are capable of supporting, without breaking, an average weight of seven drams, and the inner eight drams, whilst the usual amount of tension in all the fibres is one inch to the foot. The fibres, like all other silk fibres, are laid in the cocoon by the silkworm in pairs, united by their edges, and not by their flat surfaces.

All the *Saturnidæ* fibres I have examined are more or less fibrous and flat, except the English species *Saturnia carpini*, or Emperor moth, which

in North Staffordshire, spins a beautiful cocoon in the heather of our moorlands. My son has drawn for me an enlarged microscopic appearance of this silk, which shows its transparent and fibreless nature; and also, what is very curious, that the fibres are round except where they come in contact, when they become flat, no doubt from pressure. This apparent exception to the *Saturniidæ* depositing flat fibres, and the *Bombycidæ* round ones, which I had established, possibly points to the secretion of the sericene in the different species varying in fluidity, that of the *Saturniidæ* being excreted in a more fluid state than that of the *Bombycidæ*. There may also be a difference in the structure of their seripositors; but this I have not had an opportunity of investigating.

I am glad to state, the other diagrams were prepared for me by Mr. Rider, a pupil of the Leek Art Class. The maps, showing the wild silk districts, were done by Mr. Alfred Moore, of Leek, and I have been much helped in the microscopic work by my assistant, Mr. Rigby, and I must not omit to mention the assistance rendered me by my printing staff.

It is a fallacy, held by some entomologists, that the worm twists the two threads together as it forms them at the orifice of its spinnarets, in all species, both *Bombycidæ* and *Saturniidæ*. The two threads are simply laid side by side, as you see in the diagrams. It would be impossible to twist the two threads without the worm itself revolving continuously with the emission of the silk, or for it to have spinning wheels at the secreting orifice. I propose, therefore, to change the word spinnaret, which conveys an inaccurate impression, and substitute for it seripositor.

Leaving now the more beaten track of the natural history side of the question, I come to speak of its merchantable and art side. Finding, many years ago, that tusser silk opposed a resistance in no ordinary degree to tinctorial matter, I took an interest in the subject with a view of overcoming this resistance. In its small affinity, ordinarily speaking, for colouring matter, it ranks with the vegetable fibres of cotton and flax, and whilst, in many processes, it would come out scarcely tinted, the mulberry-bred silk would be found to have seized the colour with avidity. It, however, takes the aniline dyes, under certain conditions, moderately well. At that time, and for some years previously, little tusser silk had passed through the dye-houses. About forty years ago an attempt was made to introduce it in Macclesfield for sewing silk for black, but, on account of its irregular way of taking the dye, it was abandoned. Mr. David Clarke, of Macclesfield, at that time with his father, Mr. Jeremiah Clarke, were much interested in bringing it to the front; but, as Mr. D. Clarke informs me, the second parcel not coming from the dyer in a saleable state, a costly trial took place at Chester to determine whether the blame lay with the dyer or the silk. I believe it was decided in favour of the manufacturer, and against the dyer, who, unfortunately for him, had succeeded in dyeing the sample parcel successfully. However, the result was that little or no tusser silk has been used for sewing purposes from that day to this. About twelve years ago I made many experiments in dyeing this silk, and had the satisfaction of seeing my way to further utilisation and improvement. In 1873, the firm of which I am senior partner, consisting of my brother and myself, exhibited, at the International Exhibition, at South Kensington, the result of progress up to that time, in a series of black and coloured silks, which were in advance of any similar effort, either English or Continental, as far as my observations or knowledge extended, and they attracted a good deal of attention and led to a further utilisation of tusser silk then a drug in the market, except for dress silks for women and girls in the undyed and pleasing shade natural to it, which is fawn colour.

The development up to that time had been that this silk could be dyed into any middle or dark shade of drab, slate, brown, green, violet, or dark red, whilst, to pale shades of blues, pinks, cerise, scarlet, and others, the dark natural ground colour of the silk interposed an insuperable barrier, as sulphur, or any then known bleaching agent, could not reduce the silk to a whiter state. The *desideratum* of pale shades led our quick French neighbours to study the composition of the brown colouring matter, and to find a solvent for it. The credit of this achievement must be awarded to M. Tessié du Motay, who was led to try permanganate of potash, which was at that time attracting much attention on account of its great oxidising power on organic matter. He found the browny colorant yielded to this agent. Unfortunately, the oxidising action being too violent, the fibre of the silk as well as its coloration was affected, and the silk was tendered by the time it became white enough for dyeing into pale colours, so much so as to render it useless. However, a secret had been discovered, and it was this, that oxygen, under certain combining conditions, united with the colouring matter, which then became separated from the silk. The object now was to apply the oxygen under gentler conditions. This M. Tessié du Motay again succeeded in doing, and in a very ingenious way. He brought into contact with the silk an insoluble body, which, on contact should yield up an atom of oxygen in the nascent form, which should gently unite with the fawn-coloured matter of the silk without attacking the fibre. This, although a rough method, solved the difficulty, and the silk, originally of the colour of this sample, can now be bleached in this way to that of the sample I show you, which is of sufficiently pale a ground to admit of its being dyed into any pale colour except white. The substance he found to comply with the required condition is binoxide of barium. Unfortunately, the process is too expensive, and prevents an extensive utilisation of tusser silk, but there is a probability of the principle being shortly applied by other methods, which will be at the same time cheaper and more within the legitimate sphere of dye-house technical operation than that of M. Tessié du Motay, I mean whereby the nascent oxygen shall be presented to the silk in the vat from a solution, instead of from a solid, as at present.

In 1874 I had the honour to receive a communication from Sir Louis Mallet, Under-Secretary of State for India, asking me to communicate, "for the information of the Government of India, any details I might be in a position to furnish on the subject of dyeing the wild silk produced by the tusser worm."

On my report being received, I was requested to make a full investigation of the subject, which divided itself naturally into two heads, a consideration of the silk, and of tinctorial matters. For the first, I found the raw silk as it comes into this country to be prepared by the natives of India and China in such a rude and filthy state as to interpose unnecessary obstacles to its taking the dyes. I felt sure that cleaner and more skilful methods of reeling and preparing the silk for the market, would be accompanied by less resistance to tinctorial matter, as well as furnishing a greatly improved quality. At my request, orders were issued for the collection in the different provinces of India of a complete assortment of native dye-stuffs as well as a supply of tusser silk.

In recommending the Government of India to have the natives taught the dyeing of their wild silks with dye-stuffs indigenous to India, I had two motives, one to prevent the native art of India being tampered with by the introduction of European fugitive dyes and crude colours, and another that they could be made to utilise, what their country has ever been so rich in, the remarkable variety of native-grown dye-stuffs, which in other than wild silk fabrics, they have known probably for thousands of years so well how to use. To take dye-stuffs to India must surely be carrying coals to Newcastle. I have since received an extensive and most interesting series of India dye-stuffs and tanning materials, which I have at present under examination. I also received a quantity of tusser cocoons, and, not being able to have them reeled in England, I was authorised to go to Italy to see if I could have them reeled there, and effect my hope for improvement in the manufacture. By the introduction of a friend I obtained permission to visit one of the filatures in Piedmont, that of Messrs. Gaddum and Co. On arriving there I found an extensive mulberry silk reeling and throwing establishment, situated in a most beautiful valley, in one of the southern spurs of the Alps, about three hours' journey north of Turin.

On explaining my mission, and showing the wild cocoons, I was told there was not much chance of success, for they had several times tried them, and had found them difficult to soften, and impracticable to work; but knowing too well how natural is the tendency of mankind in any new idea, to suggest objections rather than the means, I asked for permission to be allowed to try myself. The permission being generously granted, and every assistance kindly afforded me, I was taken to the reeling room, where about 100 young women were at work, with well-trained fingers, reeling the small Piedmont cocoons of *Bombyx mori*. The operation was interesting in the extreme, heightened as it was by their strange singing of old French songs, in a dialect not even understood by the Italians, a strange and all but forgotten tongue, which has to be learned by the mill-overlookers before they can communicate their instructions to them. I was told these girls were the descendants of Huguenot refugees, escaped probably from Provence, to the Italian side of the Alps, at the Revocation of the Edict of Nantes, and that they still retained their patois and their folk lore; they worked hard for the few months of cocoon reeling from five in the morning until eight at night, for a franc a day; after work dancing and singing for the hour before bed-time in the most joyous way. Apartments are provided for them at the factory, and when the reeling season is over, they separate and return to their Alpine villages, to wait for the next season's work.

The operation of unwinding silk from the cocoon is as follows:—A number of cocoons are immersed in an iron pan, in water, nearly boiling, with a little alkali to soften them. A semi-rotating brush is placed over them which quickly catches the exterior fibres of each cocoon, and the more readily enables the reeler to find the windable thread. They are then taken out and transferred to the reeler, who sits leaning over an iron pan of about 12 inches in diameter, in which she has a few cocoons in hot water, the found ends of several being in one hand. Four or six cocoons, as the case may be, are being simultaneously reeled into a single thread by the reel at her back, which draws off over her head the cocoon threads, they dancing and turning in the water. When a thread breaks, or the cocoon is reeled, another is quickly presented from the lot in the other hand, the manipulation being one of great dexterity. Several years are required to attain proficiency, and it is not until the fifth to the seventh year that a reeler is entrusted with the most delicate reeling; the keeping of the size of the thread regular and free from rough places being the most important care.

It is this branch of the manufacture that in tusser silk is so defectively treated in India, the reeling being done in some instances round the naked knee cap, but generally with this hand reel.

I took some of my wild cocoons, and, with much difficulty and patience after several trials, succeeded in softening them by the aid of long-continued boiling in water, to which was added soap, potash, and glycerine. When soft enough, one of the most skilled girls was told off to reel them for me, and, after ridding the cocoons of the outer and coarser threads, she reeled the thread of four cocoons into one, almost without a break, much to her own delight and to the surprise of my friends and myself.

The next day, the resulting tusser raw silk was taken to the throwing mill, and there made into organzine and tram, of such fineness as to surprise my friends, who said that they had no idea that tusser silk could

be made so fine, and that they should think seriously about sending a person to India to collect tusser cocoons, that their work-people might wind them after their mulberry crop had been finished.

The usual size—that is, thickness—of thread of tusser raw silk of commerce is 153 to 255 deniers—that is, skeins of 1,000 yards long, weighing 9 to 15 drams. From some of the finer raw silk, a size of 6 to 7 drams is obtained, but it is generally coarser. From the cocoons, the reeling of which I superintended, I obtained a size of 51 deniers, or three drams, per 1,000 yards, a sample of which I have the pleasure to show you.

Here are samples of tusser raw and thrown silk I have received from M. H. Meyer, of Milan, obtained from cocoons I sent him. The size of the raw is 23-27 deniers, or 1½ drams per 1,000 yards; the organzine and tram are 50-55 deniers, or 3 drams. He found some of my cocoons very difficult to reel, no doubt owing to their age, and to not having been reeled before weather exposure. Fourteen pounds and-a-half yielded one pound of raw silk. He informs me that some cocoons he has just purchased in Marseilles are larger in size than those I sent him; they are darker in colour, but reel much better. He is obtaining from ten pounds of them one pound of raw silk.

Even a finer thread might be obtained, but as the fibre is only the 1/710th part of an inch, or three times as thick as ordinary silk, I think 51 deniers is a good and practicable limit when native reelers can have proper appliances, and be taught to be as handy as the reelers of Italy or the south of France. I dare say some of my hearers may remember the improvements which took place in reeling the mulberry silks of Bengal and Brutia, when superior skill and machinery were introduced, a good many years ago. Before that time Bengal silks were held in very low estimation, and were very difficult to work, but after the introduction of better appliances, Bengal silk was shown to be as capable of refinement as any other; and Brutia silk now commands, by its superior quality, the highest price in the market; and I have no doubt that, in degree, equal success lies waiting for the tusser silk industry.

I trust I may point to this manufacturing development and great improvement with pardonable pride, more especially as I am not a manufacturer, and could scarcely expect to find untrodden ground in a domain distinct from, although allied to, my own.

The new reeled silk is much lighter in colour, as you see, than native reeled, and has very much more lustre; in fact, it is the most lustrous in the undyed state of all silks, and possesses greater strength and tension. I found, what I expected to find, that the silk thus reeled dyes much more easily, more shades and lighter ones can be dyed upon it than native reeled, it has no disagreeable smell, and only loses two ounces per pound in being cleaned for dyeing, where native reeled tusser loses in some cases as much as six to seven ounces per pound, and never less than four to five ounces. It is as clean, to use a technical term, which means free from slubs and irregularities of thread, as ordinary silk. The cost of reeling new and good cocoons, and manufacturing them into organzine and tram, is about seven shillings per pound, and it is certain to make its way in many fabrics where extreme fineness is not required, and for a variety of purposes in passementerie, trimmings, braids, scarves, broad and narrow goods. It is beginning to be largely used for these purposes in France. Its price has lately risen, whilst that of other siks has either remained stationary, or actually depreciated.

I have urged on the Government of India the importance of introducing to the natives of India the European modes of reeling cocoons, and some time ago drew their attention to an invention which simplifies and economises this operation.

Mr. Mackenzie, engineer, of Milan, has introduced a Milan house of filateurs, who have invented and patented another mode of reeling, by which skilled labour is dispensed with. If this machine is pronounced by experts to be a success, there is no reason why cocoon reeling should not be carried on in any village home, as flax spinning was formerly.

M. David, the largest ribbon manufacturer in St. Etienne, seeing this improved manufacture and dyeing in the Indian Section of the Paris Exhibition, where they were first displayed, offered to buy all the cocoons produced in India, if the price would not be more than one franc per kilogramme, a price which Dr. Birdwood assures me is reasonable. He has applied to the Indian Government for 2,000 kilogrammes of cocoons for experiment at his own cost. It would be a very good thing for a trade to spring up in tusser cocoons. The natives could easily be encouraged to breed a larger supply, whilst improvements in reeling would require time, and would meet with obstacles of race, religion, and habit difficult to overcome, also the enterprise in this direction would have to be purely private and mercantile, as I think the Government of India would not enter into commercial undertakings, but would probably, and certainly ought to, give most strenuous encouragement and help to stimulate the further spread of this most interesting industry.

I was requested by Dr. Birdwood last year to exhibit the developments of which tusser silk was capable, in the Indian Section of the Paris Exhibition. Sir P. Cunliffe Owen entered most warmly into the idea, and took the greatest interest in it throughout, giving me all the encouragement and help required to make it worthy of being represented side by side with the beautiful objects in which India had determined to assert herself. In no exhibition before had India been shown in a manner so worthy of the gorgeous East. It was the India of the artist which asserted itself at Paris—the old historic land, from which art manufactures in brocades, printed calicoes, jewellery, ivory-carving, and pottery may still draw their highest aspirations. Neither had ever before been so much done for the promotion of Indian commerce. These results are entirely due to Sir P. Cunliffe Owen, and to one who so ably assisted him, Mr. P. C. Clarke.

In the wild silk exhibits which I was entrusted to bring together in this Section, not only were the improvements shown in manufacturing and dyeing, to which I have alluded, but another and more decorative phase, and one developed, so far as I can gather, for the first time in the history of either the East or the West—that of printing. It had struck me that fabrics made of tusser silk, either of native or home manufacture, would be susceptible of much enrichment if they could be printed upon. After many fruitless attempts, I at last succeeded, and since that time I have had the satisfaction of succeeding in applying and fixing a much wider range of colours.

Thinking that designs of an Eastern type were naturally the most applicable to cloths of this wild silk, I have obtained, by the courtesy of Dr. Forbes Watson, the loan of a large series of wood printing blocks, of native design and workmanship, from the India Museum. I have used them for printing nearly all the illustrations of my lecture, and have placed a few on the table, to show how beautifully they are cut. In England the finer details would be in copper, but in these the hardest wood has been chosen and most skillfully cut. To complete the consistency, I have adhered to the use of native Indian colours and colouring matters. You will notice the deep rich red of the India print in madder or munjeet, the good toned and permanent indigo shades, as well as a variety of other well-known native dyes. The designs on these blocks are extremely interesting, and if I had time to exhibit the whole series of the impressions I have taken from them, I am sure you would agree with me how they abound in originality and beautiful drawing. If from this we are led to think generally of the native art of India, we may justly feel some sorrow and regret that our influence there does not tend to perpetuate it, and regret with Dr. Birdwood, as he so well describes in his handbook, that it daily deteriorates. If it were not that Sir Cunliffe Owen is sitting so near to me, I might be led to suggest whether we could not try the experiment of turning the tables somewhat, and that, if we must send our art masters to India, we might at least import some from there to try to bring us into better ways.

Truly our credentials to teach an artistic people are in a sad condition; if we take but architecture for example, we are but copyists. Imitation seems to be the evil genius of the time, and even what little originality we have to be thankful for is preyed upon by an unprincipled selfishness in decorative or structural art, and is no sooner born than its rascality, which, in the greed for gain in such matters, sees no distinction between *meum* and *tuum*; whilst, on the other hand, so strong is the existing jealousy to protect that which should benefit all, that we may scarcely with safety look over our neighbour's palings to see how green his lawn is.

I would call attention to the sweetness with which the colours repose on the natural and unbleached ground of the cloth, as well as the greater sharpness and depth of those printed on bleached grounds.

Many of my examples are painted in print colours, on outline printed designs, an ancient and most interesting mode of decorating cloth, which I have revived.

I think you will agree with me that the material so decorated is beautifully suited to wall hangings, curtains, coverlids, and all kinds of furniture work, and whilst not having quite the brilliancy of the mulberry silk in its printed state, it has a richer and softer surface than those of cretonnes or challis, whilst its lasting qualities are superior to those of any other material.

Messrs. Durant, of London, have kindly informed me that tusser raw silk comes from China, and they believe the large shipments of two years ago were principally owing to the famine in the districts of productions. Scarcely a bale, they say, has come forward during the present season, nor do they expect any at the present prices. The present price of tusser raw silk in London is 4*s*. 6*d*. per lb. The stock in London is China tussore. It is collected in the district of Chefoo and shipped from Shanghai. The price of Indian tussore cloth is about 2*s*. per yard, 34 inches wide.

There is a very large quantity of China tusser cloth exported from London to the Colonies. An immense trade would be developed in India if better qualities were woven there.

The following table shows the state of the London market in tusser silk for the last few years:—

Year.	Stock, Jan. 1st.	Imported.	Consumed.
	Bales.	Bales.	Bales.
1874	662	none.	168
1875	494	none.	319
1876	175	427	174
1877	428	1,037	284
1878	1,181	887	786
1879	1,282	......	145

The stock, February 1st, was 1,137 bales, with a consumption for January of 145 bales. Should the demand continue at this rate, the supply would be insufficient for the year if no more comes in.

The average consumption for the four years ending 1877 was 238 bales, whilst the consumption for 1878, the year that attention was drawn to it by the Paris exhibits, more than trebled itself, the purchases being 786 bales for that year.

The following table shows present prices of silks in the London market (April 18th, 1879):—

	s.	d.
China raw tsatlee, No. 4, per lb.	15	6
Canton „ No. 1 „	13	6
„ „ No. 4 „	11	6
Japan „ marbush, No. 2½ „	16	0
Italian organzine	25	0
Bengal raw	14	6
Brutia „	23	0
Tusser „	4	6

The great improvements made in this country and on the Continent of late years in carding and spinning machinery, have enabled manufacturers to utilise all the silk that could not be reeled, such as pierced cocoons and all kinds of waste silk.

Mr. Clayton has been kind enough to lend me, for my lecture, illustrations of this useful phase of manufacture, specimens of spun tusser silk in each stage of manufacture, from the first carding or dressing operations to such perfected fabrics as you see before you in cloths of varied design and substance, yarns for weaving and sewing, and shawls in plain and printed states.

There is now a great demand for tusser and other wild silk waste, and England possesses more than sufficient machinery to spin all that can be imported.

Another form for the use of tusser silk is the manufacture or embroidery silks, and their application to cloth by the needle. I have had manufactured a few silks, which have been arranged by my wife for illustration this evening. She has also worked a few pieces of tusser cloth in these silks in various designs. The larger piece of embroidery, which is unfinished, is a trial piece. *Mrs.* Wardle began to work first with untwisted silk, which, as may be observed at the left corner of the work, has a fluffy appearance; therefore, I recommend for embroidery purposes a slightly twisted silk, which I think will be an improvement on crewels, and possibly filoselles, and so prove a useful industry.

THE SILK INDUSTRY IN ASSAM.

THE following is an extract from the proceedings of the Chief Commissioner of Assam, in the Revenue Department, dated Shillong, the 6th June 1879:—

RESOLUTION.

The attention of the Government of India has long been directed to the possibility of developing the silk industry of this country, and at various times information on the subject has been collected.

The most widely-distributed silkworm in India is the tasar, and it is to this that attention has hitherto been chiefly drawn. This silkworm, however, though it is found within this province, is not common. But there are other well-known silkworms which are commonly cultivated in Assam, and whose value will probably prove little, if at all inferior to the tasar, and it is in the extended cultivation and production of these that the development of the silk industry of this province obviously lies.

Besides the two which are abundant in this province, the muga and eria silks, upon which experiments have been successfully tried, there are a large number of wild silks to be found throughout this province which have never yet been subjected to experiments under trained European skill. It is very important that a sufficient quantity of the cocoons of these silk-worms should be collected and forwarded to Europe for examination. The success which has recently been obtained in the manufacture of tasar, eria, and muga silk, renders it not improbable that other common wild silks of this province will be found to have a value in the European market. It is of great importance that this point should be ascertained, as the cultivation of the silk-worms indigenous to this province will be likely to be accompanied with the least difficulty. It is not to be expected that there will be any extended cultivation of such silkworms before it is ascertained that the produce has a commercial value, and this, therefore, must first be determined. Directions will be issued for the collection of cocoons of the known kinds of silkworm, which have not yet been experimented on in sufficient quantity for this purpose.

In consequence of the very important results which have been obtained from the experiments lately conducted in Europe, which seem to point to a possible great development of the silk trade of India, further information has been called for in Government of India Resolution I. of 28th February 1879, published in the Supplement to the *Gazette of India*, dated the 15th March 1879, page 213.

This Resolution, dealing as it does with the silk of India generally, is largely occupied with considerations affecting only the tasar, and this silkworm, as has been said, is not common in this province. However it may be in the future, at present it is clear that the attention of those who are desirous of developing the silk industry of Assam should be directed to the cultivation and production of the silkworms common to Assam. It will be sufficient to note here only so much of the Resolution as seems to apply more especially to this province.

At present it would seem that the silk trade, at all events of this province, should take a new departure, and that, instead of, as formerly, the silk being reeled from the cocoons before sale, the cocoons themselves should be (after the worms have been carefully killed) sorted and packed and sent to market without any unreasonable delay; as there is some difficulty in unreeling cocoons if they are more than a year old, and are too hard and dry. This is of the utmost importance, because all the especial skill and training, and the great labour which would otherwise be involved in this industry, and which it would be particularly difficult to obtain in this province, are dispensed with.

It is only now necessary that the cocoon should be produced, and for this purpose all that will be required will be the selection and cultivation of the trees suited to the silkworm, most of which are common jungle trees, and proper care and attention to the silkworm during its growth. This will require little or no capital, and only ordinary skill and attention. In an appendix to this Resolution (Appendix B), such information as is already known on this subject in regard to the cultivation of the more common silkworms of this province has been collected, and is published for general information.

The permanent demand for cocoons of the classes common in this province cannot well be ascertained; nor can it yet be said whether the production of cocoons will ultimately prove remunerative; nor can it be said yet which will be economically the most profitable cocoons to cultivate. It will not be till after some time, and after the trade has become to some extent established, that this question can be fully answered. The trade in cocoons, like every other trade, will depend for its success on a great variety of conditions. The cost of producing cocoons in large quantities cannot practically be tested without experiment, and the same must be said of any calculation of their probable market value. The popularity of the material into which they will ultimately be worked, the cost of manufacture, and an immense variety of other considerations, must be practically determined before any real answer can be given to this question. But, so far as can at present be judged, the prospect of this trade seems eminently hopeful, and there is very much which should direct the attention of the Europeans engaged in tea cultivation in this province to this industry. As has been said, the difficulties of manufacture have been overcome, and, with the development of the industry, the cost of manufacture may confidently be expected to decline also, and this will probably result in increased demand for the manufactured articles, and enable a higher price to be paid for the cocoons. Already, one silk manufacturer, M. David of St. Etienne, has expressed his willingness to purchase 2,000 kilogrammes [55 maunds] of tasar cocoons at 1 *franc per kilogramme* for experiment, and there can be no doubt that manufacturers would be found to purchase at a similar price cocoons of other kinds. This gives a price of altogether 30*s.* per maund for the cocoons *delivered in France*, which, with exchange at 1*s.*6*d.*=Rs. 20 per maund=8 annas per seer, to cover all cost of culture, collection, and transport. It has been further asserted by M. David and other manufacturers that all the possible production of India would be eagerly bought at this rate. This is probably too low a rate to be remunerative to the producer, but it must not be considered as the final or fixed market rate of the future. The Government of India, in Resolution I. of 28th February 1879, paragraph 6, assert "there is at least as great a demand in the European markets for the cocoon of the eria and muga worm, as there is forth of the tasar." It should be noticed further, that there is a use for waste and for pierced cocoons, as these, where they cannot be reeled, can be spun.

The great abundance in the jungles of Assam of the food required by the several kinds of silkworm, and the ease with which many of the trees and shrubs requisite for their food can be obtained in the wild state, and could also be cultivated, render possible an almost unbounded development of the production of cocoons. No difficulty need be anticipated as regards carriage of the cocoons, nor need there be any delay likely to cause harm in transporting them to the manufacturer.

* * * * * *

Looking to the great importance to the province of Assam of the development of a new industry, and the production of a new export staple, the Chief Commissioner is anxious that every effort should be made to develop the silk industry. He therefore solicits the active co-operation of the many European gentlemen resident in this province. He feels sure that there must be not a few gentlemen whose training and tastes and opportunities, must enable them to render very material assistance, both in collecting the information now called for in para. 7 of this Resolution, and in making collections of wild silkworms, cocoons, accompanied with information regarding the natural history of these silkworms, and the price and probable quantity in which they can be obtained at present, either wild or under any system of cultivation.

But, above all, the active co-operation of European gentlemen is needed if the cultivation of the more commonly-known silkworms of Assam is to be developed, so as to form an important staple of trade. There is much cultivation of silk in Assam, but such as there is, is chiefly in small quantities, and for home use. There does not seem to be any reason why the production of cocoons should not be

almost indefinitely extended. The Chief Commissioner will be glad to hear that the subject has engaged the active attention and interest of gentlemen in this province. Communications conveying any information of interest on the subject should be addressed to the Secretary, and will always receive the Chief Commissioner's attention; and he hopes that in addition to the replies which will be received from Government officers in answer to the inquiries contained in paragraph 7, valuable information may be supplied to him by many gentlemen in this province.

By order of the Commissioner of Assam.

S. O. B. RIDSDALE,
Secy. to the Chief Commr.,
Assam.

In an appendix a note is made on a few of the more important facts known on the subject of practical sericulture in the province of Assam. It says:—

As regards their treatment, the natural distinction of silkworms is into those which are wholly domesticated and those which are partially domesticated. About the wholly wild silkworms which are collected from the jungles, such as is the case generally, though not invariably, in India with the tasar silkworm, little need be said. It may, no doubt, be possible to give some artificial stimulus to their production, and in a sense they may then be said to be partially cultivated. Also many of the wild silkworms may be capable of being domesticated. This is a point which can only be determined by experiment. It may be doubtful whether any large trade in wild silkworms be possible in this province; but when once the cocoons have been collected, the general remarks which are made below on the subject of sorting the cocoons, and packing and despatching them, will apply to this class equally with the other classes.

The chief partially-domesticated silkworms of this province are the muga or moonga, the tasar or kutkuri, and the *Attacus atlas*. The two latter, the tasar and the *atlas*, are also found in a wholly wild state, and a silkworm, probably the same as the muga of Assam, is found wholly wild in Cachar. Some of the other wild silkworms of this province are said to have been partially domesticated. In Assam the muga may be said to be wholly domesticated, but in its general treatment corresponds to the tasar and *atlas*, and other wild silk worms which have been at times partially domesticated, and it is convenient therefore to consider the muga as of this partially domesticated class.

The difference in treatment of this class of silkworms consists in this, that they are fed out of doors and not kept within houses. The muga eggs are laid on small bundles of grass or straw, half the thickness of a finger, and tied to the trees before they are hatched. The muga worms are reared on the trees, and standing in the open, and not on leaves collected and given to the worms in houses, as is the case with Pat and Eri. Great care has to be taken to destroy the ants, which would otherwise kill the silkworm. This is frequently done by putting baits of molasses, fish, or dead toads, at the foot of the tree. But, besides these enemies, the presence of a large collection of silk worms is sure to attract other enemies. crows, wasps, and the ichneumon by day, bats, owls, and rats by night, will, unless guarded against, destroy great numbers of the silkworms.

The silkworms themselves are prevented from leaving the tree by bands of some smooth substance, such as fresh plantain-leaves, over which they cannot crawl. If all the food of the tree has been eaten, they are allowed to descend, and collected and put on another tree. When about to spin, they will descend the trunk until arrested by the plantain leaves. They are then collected in baskets, and over these baskets are suspended branches of dried leaves, up which they crawl and form their cocoons. Many silkworms drop off the trees, and the ground under the trees on which they feed should therefore be kept clear, to enable them to be easily found and replaced on the tree. Continual heavy rain is apt to wash them off the tree, but otherwise they seem to be able to protect themselves from the rain by crawling under the leaves.

A curious fact which has been noted in regard to these partially-domesticated moths is that it frequently happens that if a female moth be fastened out at a convenient place at night, a wild male moth will discover and impregnate the former. This fact is sometimes made use of to strengthen the breed of comparatively wild silkworms, which seem often to deteriorate under domestication.

A further point may be incidentally mentioned,—that crosses between different kinds of silkworms have often been attempted, and with some success, but this subject requires too elaborate treatment to be conveniently dealt with here.

Of the remaining cocoons, after the selection has been made for breeding, a further sorting will have to be made.

The French growers sort the cocoons of the single common silk worm (*Bombyx mori*) into as many as nine varieties, distinguishing the good ones from those in which the worm has died, and making other distinctions required by the trade. The reeling of silk from the cocoons is nearly all done on the Continent of Europe, and principally in the south of France. As a branch of manufacture reeling is unknown in England, which latter country only works up the reeled silk. The trade in cocoons would therefore be, at least at first, with France, and for the purpose of ascertaining what assortment of cocoons was required, it would be necessary for the grower to put himself in communication, through his agents, or otherwise, with the manufacturers of that country. There would be no difficulty whatever in this, and when once it were ascertained in what manner the cocoons should be sorted, there ought to be little practical difficulty in sorting them. In despatching specimen bales the point of importance would naturally be to make the bales as like the samples as possible; and probably at first it would be well to make as many distinctions in the cocoons as were readily noticeable, and to err on the side of over-minute distinctions rather than otherwise. The manufacturers would at once point out which distinctions were of importance, and which not so.

Ill fortune has attended the first attempt of the Minister of Agriculture in Germany to introduce and acclimatize the *Rombyx Yama-Mai* or Japanese oak-leaf-eating silkworms. The consignment of eggs obtained for this purpose was packed in four bags of "white shortings" enclosed in an air-tight box. On opening this it was found that many of the eggs were quite mouldy, while others had hatched out on the long voyage from Japan, and in the absence of food had succumbed to starvation. —*Home and Colonial Mail.*

The Americans seem determined to try everything. Professor Riley has reported favourably to the Agricultural Department on the prospects of silk-raising in the United States. For many years Professor Riley has given much attention to the habits of the silkworm, and since he became connected with the Agricultural Department he has been conducting experiments in silkworm culture. He has now put forth a report embodying the result of his studies, in which he takes the ground that the culture of the worm and the manufacture of silk may be made an extensive and profitable industry in the United States. At present there is no home market for the cocoons; but that objection Professor Riley hopes will soon be overcome. In the course of an extended series of tests, the Professor finds that the mulberry may be entirely dispensed with, and the leaves of the Osage-orange—a very common hedge-plant in sections where the climate is favourable to the silkworm culture—may be substituted without in any degree impairing the result.—*Ibid.*

IMPROVEMENTS IN REELING SILK.

REELING silk from the cocoon has never been profitably done in this country. In France the operatives earn an average of one franc, or 10*d.* a day. In China and India the remuneration is still smaller. In no part of the world, however, does the silkworm thrive better than in this country. The mulberry tree, upon whose foliage it fattens, will flourish in our soil. In fact, at this time, hundreds of thousands of dollars' worth of the eggs alone are exported from California, Kansas, Missouri, Louisiana, and other States, to Europe and Asia, because of their superior quality.

In the existing process, the cocoons are put into a vessel of hot water, and there in the felting of silk of which they are composed is softened. This felting, though one-eighth of an inch thick, is made up of a single thread, and when softened and a slight pressure is brought to bear upon the end of the thread or filament, it unravels with facility. From five to seven of these filaments are joined to make up a larger thread. This work has always been done by hand in great part. Steam is sometimes used to draw these threads, but the difficulty is that the machinery cannot be stopped quick enough when the filaments part, and for this reason the thread formed by joining several filaments is likely to be far from uniform in thickness.

Edward Serrel, Jr., an engineer, became much interested in silk culture two years ago, after reading an exhaustive article on the subject. There the difficulty of reeling the staple was clearly demonstrated. He fancied that the problem might be solved with delicate electrical machinery. He visited the Paterson silk factories and others, and after making many designs, finally hit upon an automatic machine that he believes will fill the required conditions. This machine, which he has patented both here and in Europe, was exhibited recently. Mr. Serrell says it is an improvement upon the French, Italian, and Chinese reels. It has an electric stop motion by which, while several reels are run at a time by an operative, they in effect watch themselves, or rather the electricity watches, much more sharply than could the most experienced operative, and if the thread or any single filament suddenly parts, the reel as suddenly stops and the filament is united. The little contrivance over which each filament runs is about an inch in height and is deliberately poised upon a rivet that runs through it, and is sustained by standards. When the filament is running steadily across it, it is stationary, but if the filament breaks, its two little arms fall into a gutter filled with mercury, connecting with the battery. This at once completes the circuit, a little bell is rung in the engine room, and the machine is at once stopped. By this means an ordinary operative (Mr. Serrell says), may easily reel from thirty to forty pounds of silk in a week with certainty and ease.

The silk industry of this country is valued at 25,000,000 dols. and the whole silk trade at about 50,000,000 dols. The cocoons are raised here, sent abroad to be reeled, and then brought back in the form of twist to be manufactured.—*American Paper.*

CHINESE SILK.

THE extraordinary backwardness of this present season has been very distasteful to silk producers throughout Europe, who have been without the mulberry leaves upon which alone their *protégés* are wont to feed. The Western markets of the world are thus to a great extent thrown back upon the supplies from China, where the manufacture of silk was first practised some two thousand years, as is supposed, before the Christian era. According to Gibbon, the first introduction of the manufacture into Europe was made by Justinian, in the sixth century, and it is said that in the twelfth century it found its way into Sicily, whence the Saracens imported it into Spain in 1253. The French do not appear to have practised it till the sixteenth century, when Francis I. planted it at Lyons, its present stronghold; and England not before 1585, when it was brought over from Antwerp to London. Of late years the importation of raw silk from China to this country has enormously increased, while, according to some statistical tables in the *Statist*, its value has declined in something like an inverse ratio. In 1867 the imports are set down as amounting to only 40,000 lbs., averaging 25*s.* per lb. This quantity was more than doubled in the next year, while the price fell to 22*s.*; and in 1869 the imports trebled the amount of the preceding year, while the price, instead of again falling, advanced a little. 1873 may be taken as the year when a limit began to be found to the great expansion of the trade, and the imports had then reached almost exactly three million pounds, while the price was almost exactly £1. There have been some fluctuations since then, caused chiefly by the comparative success or failure of the European crop. Thus the value of the imports in 1874 was under two millions sterling; while in 1876, when the European growers had a bad year, their value was 4¾ millions, and the quantity imported reached the high figure of very nearly five millions of pounds. The price last year was 17*s.* 3*d.*, after having varied in the seven preceding years between 14s. 3d., which was the lowest, and 20*s.* 6*d.*, which was the highest charge paid.—*Globe.*

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA: WEDNESDAY, 1st OCTOBER 1879. [No. 10.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS:

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

CORRESPONDENCE.

THE ARAKAN EXPERIMENTAL FARM, MYOUKTOUNG.

TO THE EDITOR.

SIR,—In your editorial notes (July last) you express a wish "to learn whether tobacco is succeeding there (in Arakan, I suppose you mean, since you name Dr. Brown, though you say Burmah) or not." To set your mind at rest on this point, I assure you that tobacco does not only succeed there, but grows most luxuriously and much better than I have seen it thrive in any other part in India, and I have been over almost every part of it. To give you only one instance. In Arakan I have grown, and that without applying manure—Government not supplying me with any—but only a little wood ashes which I scraped together in the villages, here and there, Virginia and other sorts of tobacco; leaf 32 inches long, and fine enough to make the very best gold leaf, and if it has not turned out so, the extremely limited amount of labor, and bad at that even, and the want of a proper curing-house, are alone to blame.

Should you desire more information on this subject, I have to refer you to the appendix of the Government *Gazette* in which it was intended my monthly reports should be published. If this has not been done, I suppose Government has its own reasons for this. However, if you can obtain Government sanction for it, I shall be most happy to supply you with copies of them all.

C. H. T. SCHOENEMANN,
Late Supdt., Myouktoung Experimental Farm.

1, Ballygunge, September 8th, 1879.

CHAULMUGRA TREE.

SIR,—I had the pleasure of reading in your issue of June last an article concerning the "Indian plants adapted for commercial purposes," by John R. Jackson, A.L.S.

The said article calling the attention of the reader to several useful plants which are to be found in India, states that the most important of all, is the *gynocardia odorata*, or *chaulmugra tree*, on account of the great use, for cutaneous or skin diseases, of the oil extracted from its seeds, as used in several hospitals of London and Paris.

Asserting that the abovementioned tree is a native of Pegu, Tenasserim, and other parts of the Malayan Peninsula, extending as far as Assam, Kassia, and Sikhim, states as well, that, it has not reached to the central and western parts of India. It is with regard to the last assertion that I take the liberty of writing the following lines:—

I have known in many villages of Goa a tree which some persons call *Kousty* and other *Kounty*, and which I think may be identified as *gynocardia odorata*, Roxb. or *hydnocarpus odoratus*, Lindl. This tree has all the characteristics of the genera *hydnocarpus* such as diœcious or unisexual flowers with 5 sepals, 5 pitals, stamens 5, pistil 5.

But of the three species, which form this genera, are described in the *Stand-book of the Indian Flora*, by Keber Drury, the *h. odoratus* only, has characteristics more consonant to Goa *Kousty*. The *h. inebrians* has its leaves crenately—serrated, whereas the leaves of *Kousty* are entire and acuminate, as the *h. odoratus*, the flowers of *h. inebrians* being small and white, and those of *Kousty* not very small, but of a yellowish or pale-yellow colour. Besides, the fruit of *h. inebrians*, according to *Hugh Cleghorn*, *Forest of South India* is used for poisoning fishes, but as regards the fruit of *Kousty*, it is not known in Goa that it has been used for the same purpose. The *h. alpinus* has entire or uncut leaves, but not acuminate, and the flowers are of a whitish green colour, these characteristics being quite different from those of *Kousty* which, as I have already said, have yellowish flowers and acuminate leaves, like those of *h. odoratus*.

The fruits of all the three species are of a globular shape, but the *H. odoratus* is the only species which has the fruit of the size of a shaddock, exactly like that of *Kousty*.

In Goa the oil extracted from *Kousty* seeds, being used for external and internal purposes, has proved very beneficial in cases of cutaneous or skin diseases, and has an unpleasant taste and smell. For these reasons I am inclined to believe that our *Kousty* is the Chaulmugra tree nevertheless, as I cannot rely on my limited knowledge of botany, I send you herewith a branch of *Kousty*, with its leaves and flowers as well as a tender fruit of the same, hoping you will be good enough to let me know whether my supposition in this matter is well founded, if so, you may rest assured that in this country a very good quality of this oil is obtainable for a low price, as there are many trees of that kind which generally grow without much care in damp and cool soils on the brinks of streams.

The fruit which I send you is pounded because it is the only means of sending it enclosed in a letter.

J. DE MELLO DE SAMPAIO,
Captain of Engineers in the Portuguese Army.

You are right in your surmise, the plant of which you sent specimens is the *Gynocardia odorata* or Chaulmugra.—ED., *I. A.*

BEE-KEEPING.

SIR,—In reply to B. H., I beg to state that Quinby's New Bee-keeping is out and out the best work, and that it is to be obtained from Orange, Tudd & Co., 245, Broadway, New York, for $1·50.

BEE.

Kumaon, 8th September 1879.

REANA LUXURIANS.

SIR,—You may perhaps be glad to be able to publish a successful experiment with Reana Luxurians in these parts. I have therefore much pleasure in informing you that both here at Pachmarhi and also in the plains below at a place called Pachlaora, the plant has succeeded very well indeed, and is a far superior fodder for cattle of all kinds to the much vaunted but useless Prickly Comfrey, which grew here too, well enough, but of which cattle would not taste a second time while they eat the Reana greedily to the last shred.

L. GORDON,
Assistant Commissioner.

Pachmarhi, C.P., 3rd Sept. 1879.

CATTLE PESTS.

SIR,—I shall feel greatly obliged by any of your readers suggesting a remedy for those pests—the *dans* and *entuli* that infest the cattle folds in this country. The former is a sort of big fly that sends its sting so deep beneath the skin that it almost invariably draws blood. The peasants burn dry dung cakes in the cow-houses to keep off these pests, but not always successfully.

The *entuli* is a sort of vermin that manages to attach itself hard wherever it finds a nook or hiding place in the body. They are almost invariably to be found in the angle behind the ends. An *entuli* can only be pinched off from the body with great difficulty, and when taken off, blood is found to ooze out of the spot where it had attached itself. Should cleanliness be the only remedy, what particular points of cleanliness should be attended to.

A NATIVE.

29th August 1879.

The first mentioned pest is a large fly which stings freely, and the other is the common tick.—ED., *I. A.*

MEASUREMENTS OF TEAK TREES.

SIR,—A perusal of the reports upon the teak plantations at Nilambu in the Wynaad district, and of the teak forests in Burmah, which appeared in your issues for May and July last, induced me to have the measurements taken of such teak trees as I found scattered through the Tanjore district either singly or in small plantations. The largest number (82) of trees in any plantations here which I have come across, is that to be found at the Lower Coleroon Anicut about 15 miles north of Combaconum.

The soil in which all these trees are growing, is alluvial, and consists of sandy loam deposits brought down by the River Cauvery. The teak was introduced into the district by the late Rajah Surfojee of Tanjore, and a very fine specimen with a diameter of 24 inches at 6 feet above the ground was lately growing in the church compound at this station. It was cut down some five years ago at a probable age of 50 years, and went to make a large portion of the church furniture. The soil of the Town of Tanjore is lateritic and of reddish clay. The success which has hitherto attended the cultivation of teak in the Delta is worthy of the attention of the Forest Department. The soil on the margins of the Coleroon and Cauvery and its branches is especially suited to the growth of teak, and I am convinced that valuable plantations could be raised thereon, with very little care and attention required.

I append the results of my investigations :—

No. of trees measured.	Average girth at 3ft. from ground.	Total average height.	Age in years.	
1	70 inches	50 ft. 6 in.	80	at Combaconum.
2	26½ „	39 „ 0 „	10	at Combaconum.
4	47 „	68 „ 0 „	30	at Combaconum.
15	18 „	28 „ 9 „	5½	... at Cabistalam.
76	18 „	35 „ 0 „	7	at Lower Coleroon Anicut.

By comparing these results with those obtained from trees of similar age in the Nilambur plantations, it will be seen that the growth in the Delta of the Cauvery is in no way inferior to that attained in the native home of the teak tree.

R. K. C. BROCHMAN,
Captain, R.E.

Tanjore, 27th August 1879.

AN EXPERIMENT IN THE CENTRAL PROVINCES.

SIR,—Might I ask the favour of your inserting in your columns the following balance-sheet of an enterprising but ruined native leather manufacturer in this district? If you oblige me, I will briefly, in a future issue, remark on the very striking features which it discloses, and will try to explain how it happens that with raw material and labour, abundant and cheap to a degree—perhaps unknown elsewhere—the craft has been carried on at an absolute loss :—

	Rs.	A.	P.	
*Myrabolans** was bought at	1	12	0	per cwt.
Lime „	0	8	0	„
Amaltas bark † „	1	2	0	„
Linseed oil „	14	0	0	„
Skilled labour at	4	0	0	per month.
Goat skins „	0	2	6	each.

Yet this unfortunate pioneer of industry, who made an excellent article, found nothing like leather as a road to ruin.

CHARLES W. McMINN.

Raipur, 24th August 1879.

Account shewing the receipts and payments on account of tanning goat and sheep skins, commencing from 1st March 1875 to end of July 1879.

RECEIPTS.

	Rs. A. P.		Rs. A. P.
By sale of 26,358 goat and sheep skins at different rates as detailed below—			
6,462 goat 1st sort at Rs. 32 per 100 ..	1,747 13 6		
2,987 „ 2nd do. 18 do. ..	537 10 9		
8,645 sheep 1st do. 20 do. ..	1,729 0 0		
9,264 „ 2nd do. 11 do. ..	1,019 0 3		
Total ..26,358	5,033 8 6	..	5,033 8 6
By sale of 1,446 chattun skins to shoe-makers which were destroyed in the lime, at Rs. 10 per 100	144 9 7		
Do. 1,123 pieces skins eaten by white-ant and insects, and destroyed in lime ..	23 4 0		
Total .. 2,569	167 13 7	..	167 13 7
By sale of wool 3,686‡ seers at different rates—			
840 seers at 2 seers per rupee ..	420 0 0		
909 do. 2¾ do. ..	330 8 9		
1,887 do. 3 do. ..	629 0 0		
Total .. 3,636	1,379 8 9	..	1,379 8 9
			6,580 14 10
Loss		..	1,474 7 3
Total Rs. ..		..	8,055 6 1

* Harra.

† Dhunbar chalte.

‡ 37,32 seers.

 96 „ destroyed by white-ants.

3,636 net sold.

Mussallahs required for 300 Sheep and Goat skins.

Lime	20 katahs.
"Challee"* (called amaltas) and Dhanbar ..	3 pullahs = 9 maunds.
Alum	2 seers.
Myrabolans	20 ,,
Oil (linseed or sweet)	12½ ,,

PAYMENTS.

	Rs. A. P.		Rs. A. P.
By purchase of 28,927 goat and sheep skins at 16 rupees per 100 ..			4,628 5 1
Purchase of 1,928½ katahs of lime—			
1,000 katahs at 27 katahs per rupee ..	37 0 7		
928½ do. 20 do. do. ..	46 7 0		
	83 7 7	..	83 7 7
Total .. 1,928½			
Purchase of 289 pullahs of "dhunbar challee" at 2-11-2 per pullah	780 0 0		
Do. Harra 1,928 seers at 0-0-6 per seer	60 4 0		
	840 4 0	..	840 0 0
Purchase of sweet and linseed oil 964 "chabbalas"= 1,205 seers at different rates—			
164 chabbalas at 3¼ chabbalas per rupee	51 7 5		
200 do. 3 do. do.	66 10 8		
200 do. 2½ do. do.	80 0 0		
420 do. 2 do. do.	200 0 0		
Total .. 964	397 2 1	..	397 2 1
Pay of establishment from March 1875 to end of July 1879			1,837 12 0
Purchase of "pitkurree" 193 seers—			
113 seers at 4 seers per rupee	28 4 0		
80 do. 6 do. do.	13 5 4		
Total .. 193	41 9 4	..	41 9 4
Cow-dung cakes, purchase of	12 4 0		
250 mud pots purchased at 6 pie each	7 13 0		
Hemp for ropes	10 0 0		
Repairing of the "takahs" huts and tubs, &c.	125 0 0		
Purchase of baskets (large and small)	10 0 0		
Paid on account of rent of land from 1st March to end of July 1879 at Rs. 14 per annum ..	61 13 0		
	226 14 0	...	226 14 0
Total Rs. ..			8,035 6 1

Number of days required in Tanning 300 skins—

In Hurra	6 days.
,, Lime..	12 ,,
,, "Challee"†	45 ,,
	63

BAMBOO PAPER.

SIR,—I send you this Mail copy of our Paper Makers' Monthly Journal printed on paper I have made at our works here, from bamboo (young stems of the season's growth), collected for me by order of Government in British Burmah; my agent, Mr. John Hannay, paid Dr. Bibbentrop, the Conservator of Forests, Rs. 15 per 1,000 for these stems delivered at Rangoon; they were floated down 120 miles from the Pegu Forests.

I mention these two facts, *cost* and *floating*, in practical refutation of the unwarranted assertions of Dr. King, that young bamboo stems would not float, and that they could not be procured at so low a cost as 5 shillings per ton, from the native jungle. These stems averaged green from 6 to 8 tons per 1,000; when dried from 30 cwt. to 2 tons.

Unfortunately, after being crushed, they were sent home to me as dunnage—*unpacked*, and thus contracted a large amount of mechanical dirt, which once combined with the fibre it is difficult, if not impossible, to eradicate. This, however would obviously not occur if the bamboo stems were converted into stock in a regular factory when received.

I may add also that although even from the native jungle, practical evidence has thus been given that the young season's stems can be delivered within the cost of 5 shillings per ton I originally estimated, as also that they will float, I am satisfied that greater economy of cost as well as greater certainty of quality would be ensured by following the system I have always proposed of regular plantations under irrigation.

I may add also that I have converted some tons of this bamboo into stock which will pack into compact bales measuring about 50 feet to the ton, and the yield of this per ton of raw dry bamboo exceeds 70 per cent., a greater yield than from any other fibre I have hitherto treated. I may also state that after subjecting the dried crushed raw bamboo to 2 tons pressure per square inch, I have failed to get it into a less bulk than 125 cubic feet per ton weight, thus proving that *raw* bamboo can never become an article of export.

Having thus "passed the Rubicon," that is, the experimental stage, and converted some tons of Indian bamboo into paper stock, and paper of good quality, I am able to vouch for what some cavillers might say I have hitherto only theoretically asserted.

THOMAS ROUTLEDGE.

Claxheugh, Sunderland,
28th August 1879.

The samples referred to by Mr. Routledge are in our office, and will be shown to any one interested, any day between 11 and 3 o'clock.—ED., *I. A.*

THE BRISBANE EXHIBITION.

SIR,—The National Agricultural and Industrial Association of Queensland have just held their fourth annual exhibition at Brisbane. If not crowned with that success which has hitherto been the reward of the energy displayed by the association, the unanimous opinion of all who have witnessed past exhibitions is, that the present one is the most interesting they have as yet witnessed. There are two causes tending to make it so. All the present exhibits will be forwarded to Sydney to be displayed at the International coming off there in September next, and which had induced Queenslanders to show up well, and the state of the cattle trade, the trade on which Queensland has hitherto almost wholly lived, which being considerably depressed owing to over-production, has induced men, with means however small, to make tentatives in the establishment of other productive pursuits. The result is that at the present exhibition are to be found specimens of almost everything produced or to be met with in Queensland, and Queenslanders themselves are wonder-struck to find practically how rich their adopted country really is. Australians are commonly and justly credited with an amount of vain and conceited notion of the capabilities of their country, but if any of the other Australian Colonies are able to show up so well as Queensland has done at this moment, outsiders will look upon this blow about their country as a very pardonable vice. The quantity of the exhibits was not in proportion to the extent of country, but it is to their quality that we must direct our attention.

Foremost amongst the industries stands that of sugar. The samples exhibited were good but few. This industry started in 1866; in 1867 168 tons were produced, the crop for the present year I have estimated at 14,000 tons. There are at present about seventy mills at work, Queensland exports more than half of her produce.

Tobacco.—This industry may be said to have firmly established itself. It has had many trials to go through, but is now practically thriving. The difficulty has been, not with the production of the leaf but with the curing of the same. Like sugar it grows successfully from the Herbert river to very nearly the boundary of N. S. Wales.

Coffee.—There were only three exhibits. The plant has thriven hitherto wherever it has been tried from the neighbourhood of Brisbane to Mackay and the Herbert river. It is however not expected to develop to any extent until there is a greater amount of cheap labor.

Amongst the most interesting exhibits were those of Queensland-grown fibres adapted for paper-making and other purposes (these were exhibited at Paris) and two samples of jute grown near Brisbane. These fibres are engaging considerable attention, for now that the fact of their growing well, and it is to be supposed profitably has been established, it will not be long before we see factories started. Cotton which once bid fair to be a staple industry, has almost totally collapsed, the want of cheap labor and the withdrawal of the Government bonus are looked upon as the chief causes. Arrowroot is largely grown, and has for some time past firmly established itself. There are several factories in the colony, and the samples exhibited bear witness to the superiority of its quality. Tumeric and indigo are pushing, and ginger appears to be already a staple product. Though yams and cassava were poorly represented, they thrive well. Besides the above, citrons, lemons, limes, oranges, cumquats, pine apples, and bananas were, if not largely, at least well represented. Of cocoanuts strange to say there was only one exhibit, namely, from Mackay. Collections of indigenous grasses were both interesting and instructive; owing to the extermination of many through the reckless depasturing by sheep and cattle, the preservation of native grasses and the introduction of foreign varieties has lately occupied considerable attention on the part of the squatters. Various samples of rice in sheaf and grain were exhibited; it is largely grown on the coast jungle lands. About 1½ million bushels were grown in 1877. Although the Q. tariff is on the whole light, the duty on rice is especially heavy so as to counteract Chinese immigration, which it however does not effect. The collection of Queensland indigenous timbers was very rich. Some 400 specimens must have been exhibited, and both from the variety and extent, outsiders could judge of some of the wealth extant in the Queensland forests. This part of the exhibition was enhanced by the specimens being all descriptively labelled. Happily there is some probability of a system of forest conservancy being established—if not soon carried out, the reckless destruction now

* Bark of amaltas.
† Bark.

going on will result in making Queensland, which is now the richest Colony as far as timber is concerned, the poorest in Australia.

Rather suggestive of the richness of the Queensland soils hitherto cultivated, is the fact that no manures of any sort were exhibited.

There was a large collection of essential oils and tinctures from indigenous plants and other native sources; eucalyptus resins and extracts, Dugong oil, which had it not been for the spurious imitations sent home, would at one time have cut out cod-liver oil, was also represented as well as a Dugong prepared skin and a stuffed specimen. Marsupial hides for which there is little sale at present were exhibited. Considering the thousands of Marsupials annually destroyed simply for the sake of extermination, it is really a pity that no secure and paying market can be found for the skins, but even then the difficulty remains of bringing them from many miles inland to the coast railways to market.

Amongst the more instructive collections of Natural History was a case containing a collection of insects injurious to trees and other plants.

In view of the depressed state of the cattle market and the low prices meat at present fetches, one would have expected to see several meat-preserving processes exhibited, there were, however, but three firm who showed up two of the ordinary boiling down process, and one of the Morgan so-called infiltration process. This latter process which was at work some years ago failed ostensibly for want of management pure and simple. The present exhibit consisted of a couple of casks of the infiltrated meat in brine, and a bullock's head also infiltrated, (before division from the body) which after some 5 weeks' curing smelt as fresh as newly-killed meat.

The Beche-de-Mer and Pearl-shell Fisheries showed their trophies, but will I understand be better exhibited at the Sydney Exhibition.

Few who have not visited the Queensland mines, can form the slightest conception of the mineral wealth possessed by the Colony. The exhibits in this line were both numerous and rich. The specimens of gold in quartz were some of the finest and richest known. Silver, tin, copper, antimony, cinnabar, galena, and other ores were largely represented. Nor was there any lack of precious stones, diamonds, opals, agates, &c., both cut and un-cut. Coal, too, the mines of which are about to receive a stimulus, found numerous admirers amongst those who know, as did also several beautiful pieces of marble, polished and raw.

H. L. B.

Brisbane, Queensland, 8th August 1879.

A NEW WEATHER THEORY.

TO THE EDITOR OF THE MAIL.

SIR,—I suppose everybody on occasion enacts the part of weather prophet, and sometimes his prediction comes true; but if I were to pose in that character in your columns, and proceed to make the melancholy claim of having long foretold the present dismal season, I should probably get a shrug for my conceit, if not a laugh for my folly. Dropping, then, the prophet's mantle, and arming myself only with the chronicler's pen, I would like to place on record one or two results of careful observations I have made extending over nearly 30 summers.

The first of these results is that dry and wet periods succeed one another in alternate waves of nearly equal length. Not that this equality of duration is quite absolute, or that the wave of one period is exactly the *facsimile* of that of a corresponding period at an earlier or a later time; but there is enough of regularity and uniformity about the waves to make the family likeness clearly discernible to any eye that looks for it.

These periods extend over three whole years for each, and the following simple rules will enable any one to work out the several cycles of years for himself:—

1. When the number representing any given year is even and exactly divisible by three, that year is the middle one of three cold and wet summers

2. When the number representing the year is odd and divisible by three, then that year is the middle one of a triad of dry and hot summers.

For example, 1860 is even and divisible by three, and the prevailing characteristic of the three years 1859, 1860, 1861 was wet, or wet and cold; and, again, 1863 is odd and divisible by three, and everybody remembers 1862, 1863, and 1864 as bright, hot, and dry summers.

Taking now a range of 27 years over which my own personal observations extend, and applying the rules just given, the wet and cold triads were 1853-5, 1859-61, 1865-7, 1871-3, and 1877-9, while the dry and hot triads were 1856-8, 1862-4, 1868-71, and 1874-6; and without claiming that no single year broke loose from this very simple order of seasons, I fearlessly maintain that all the markedly wet or dry summers of the past 27 years fall accurately within some wet or dry period as given above; so that no very wet year falls in what should have been a dry period, nor any very dry year in what hypothetically was a wet period.

This hypothesis receives considerable confirmation from an examination of the average prices of corn during the years already referred to. Ordinarily after a wet summer the next year's averages ought to be high, and after a dry summer the reverse. Now it is a fact that high averages prevailed from 1854 to 1856, and low from 1857 to 1859; they were up again during 1860-2, down in 1863-5, up in 1866-8, down in 1869-72, up in 1873-4, and down in 1875-7.

How far these cycles may be shown to coincide with the greater cycle of 11 or 12 years which is observed in the *maxima* and *minima* of spots on the sun's surface, is more than I have time now to inquire; but my good neighbours at Sherborne know that for some two or three years past I have been pointing out to them in public lectures most of the things I have spoken of in this letter, and I have only to regret that my "forecasts" have been more than borne out by the facts.

So much for chronicle. Now for one word of prediction. The number 1881 is odd and divisible by 3; and if there is anything in my theory, that year ought to be the middle one in a triad of hot and dry summers. I am looking forward, therefore, with much confidence to a good summer in 1880, followed by two similarly good ones in 1881 and 1882; and for the sake of every interest in the country, I earnestly hope my expectation may not be disappointed.

HENRY ROE, F.R.A.S.

Poyntington Rectory, Sherborne, July 15 (St. Swithin).

THYMOL.

TO THE EDITOR OF THE MADRAS MAIL.

SIR,—A new and powerful antiseptic and disinfectant called "Thymol" has been recently brought to the notice of the Medical Profession, and will doubtless soon become known to the public generally, as it appears to be so far superior to every other disinfectant in use that it will probably supersede them all. Thymol is a crystaline substance extracted from Wild Thyme (Origanum Vulgare,) its antiseptic power is reported to be eight times as great as that of carbolic acid, and it enjoys the advantages of possessing a pleasant fragrant odour, and being perfectly harmless. I have no doubt it is already well-known at the Presidency towns, and my object is not so much to recommend it to the public, as to suggest certain uses to which it may be applied in warding off, or possibly curing sundry diseases to which humanity is subject. Thymol has the power of arresting fermentation; one part in a thousand is sufficient to effect this; although our knowledge of the action on and in the system of the poisons which cause certain diseases, is still very imperfect, yet we have reason to believe that in many cases they set up fermentation, causing putrifactive changes. Such are the poisons which produce diphtheria, cholera, and typhoid fever, and probably malarious fevers are produced in the same way.

That drugs possessing antiseptic qualities have the power of preventing, arresting, mitigating, or curing certain diseases, we have satisfactory proof; among the most powerful may be mentioned carbolic, nitrous, and sulphurous acids. But these and many others have the drawback of being highly irritant, corrosive, and poisonous in large doses. Carbolic acid has hitherto held the first place as a remedy for the destruction of low forms of animal and vegetable life, and for preventing fermentation; owing to its possessing these properties I employed it about ten years ago in the treatment internally of epidemic cholera, the result as far as it went was most satisfactory; about 70 per cent. of my patients recovered; the usual mortality averaging 50 per cent. I have seen too much, however, of the vagaries of cholera to make deductions from the experience of one epidemic, and have not since had the opportunity of testing the value of the drug in any widespread epidemic. I think from my experience however that I am fully justified in recommending the more powerful, and at the same time more agreeable and comparatively harmless antiseptic Thymol in the prevention and treatment of this and other diseases; if, as supposed, the poison of cholera consists of a germ or low form of life, which sets up fermentation in the system, we have here apparently a remedy capable of doing battle with the enemy. That its employment as a purifier of air and water during an epidemic would be a safeguard to a great extent, lessening the liability to contract the disease, there can, I think, be no doubt, but I have great hope that in it we shall also find a cure for the disease if administered early, before the vital powers have become fatally depressed. I have, by accident, just seen a statement in the *Lancet* that Thymol has not an agreeable flavour, and that it has consequently been prepared in capsules each containing one grain of the ingredient, and it is recommended to persons suffering from dyspepsia, in which putrifactive changes take place in the stomach; now, I think a few of these

capsules taken with each meal would be an additional safeguard during the prevalence of epidemic cholera, for notwithstanding all theories to the contrary, I am convinced that the disease is more often taken into the system with food and water than through the medium of the air. With regard to the cure of the disease, I would administer as much as the system could bear on the appearance of the first premonitory sign, when the absorbent power of the stomach is still in force, and trust to its counter-acting influence in the blood. There are other diseases in which Thymol will be found most useful, but I desire now particularly to recommend its use as a prophylactic, and perhaps a curative agent in cholera, and I trust some of my medical brethren who have the opportunity will give it a fair trial.

Yours, &c.,
O. A. A.

A CASE OF FRAUD.

TO THE EDITOR OF THE NORTH CHINA HERALD.

SIR,—The following incident is at present being talked of in tea circles. My information comes entirely from native sources, and is as follows :—

A certain foreigner is reported to have bought a chop of Congou last season. The usual course was adopted by the godown-man of weighing every package as it came in, and finding the weights ran evenly, he concluded all was in order. A percentage was then taken from the bulk, which was weighed, and the packages opened and inspected by the foreigner and duly passed as equal to muster, and then shipped off. On arrival in England, 100 packages were found to contain only broken leaf tea, which sold at 8*d.* per lb, whereas the remainder, similar to what the exporter contracted for, sold at 1*s.* 6*d.* per lb., and I am told that a certificate duly signed by four London brokers was sent out to that effect.

I am informed that the native agreed to refund a portion of the loss, but kept putting off the payment. The foreigner is said to have purchased from him tea amounting to the promised sum, and naturally enough placed it as a set-off against the loss. The Chinaman declined this method of settlement altogether.

It appears that a meeting of the Tea Guild has been held, and it is said that all the hongs have been instructed not to send any more musters to the foreigner in question until his last purchase is paid for leaving the original dispute unsettled.

I have held several conversations with natives on the subject, and even the most respectable have changed their ideas and express the most dangerous views. They now argue that as foreigners refuse to entertain claims on piece-goods once removed from their godowns, so are they justified in not recognising any such claims as I have mentioned.

They further refuse to guarantee the bulk in any way, but say the purchaser can open every package at his own expense (Tls 12 per hundred.)

To any firm largely interested in the trade, such a mode of procedure would be manifestly impossible.

No parallel case has arisen in the sale of piece-goods to that which is now cited; the only claim which has ever been preferred has been for mildew or for deterioration on the voyage, but never for dishonest enclosure of foreign materal; or in other words, if 8¼lb. Shirtings of a certain standard have been sold, the same goods have been delivered, and in no instance has a bale been found packed with cotton waste or other extraneous substance.

In a trade where good faith on the part of the seller is so material to the welfare of all concerned as in the tea trade, it is most important that no suspicion should attach to any one concerned in the business.

The whole question is of such gravity to all concerned, that I trust the matter will be seriously taken up, and if necessary, the active intervention of the Chamber of Commerce invited.

Trusting you may be able to spare space for the foregoing,

I am, yours truly,
TEA INSPECTOR.

Shanghai, 16th August.

TOBACCO CULTIVATION.

TO THE EDITOR OF THE MADRAS ATHENÆUM.

SIR,—It would be well that you call the attention of your tobacco planters to the fact that they should now be getting up their seed beds and sowing seed, so that the plants will be ready for setting out by 1st November. The weather is now all that can be wished for, and no time should be lost, for one genial shower of rain is worth more to the plant bed than half a dozen waterings. 1st—Plough or dig the ground at least twelve inches deep, break all the clods or lumps of clay as fine as possible, and work in a good quantity of wood or vegetable ashes. I would prefer that the seed bed be six inches higher than the ground, so that the plants or seed may not be injured by excessive rain, and I would advice that the seed be sown in drills, not broadcast, for this reason ; if you sow in drills, you can the more easily weed, water and pull the plants, without trampling on them Your seed bed can be a part of the tobacco field, and a piece of ground 80 × 50 feet, will give you sufficient plants for several acres. Do not sow your seed too thickly. Any fairly good ground will suit for tobacco. I would prefer it a little sandy ; you can always manure poor land, whereas, if it be too rich, the plants and tobacco will grow too thick and rank, and not be suitable for cigar making. In America a good loose sandy soil is always preferred. As soon as the seed is sown, the planter should at once plough the ground for tobacco as deeply as possible, and let it be so for at least two weeks, so that it be subject to atmospheric influence, when it will be more easily pulverised ; it should then be harrowed once or twice, before the second ploughing. If you have no harrow, you can improvise one by using a branch of tree, on which you can tie some large stones. If procurable, use the seed known as the "James river." I believe it can be got from the Secretary of the Horticultural Gardens, but I would strongly recommend the planter not to sow seed of his own raising. In England and America, no farmer will sow his own seed, but rather that from a farm some miles distant. By no means water your plants in the morning, but after the meridian sun has passed. If you water the bed in the morning, your ground becomes hard and the water will evaporate, whereas if you water in the evening, the water has a chance to percolate to the roots of your plants. Neither water too much. You do not require to flood your plant bed ; moderate watering is always the best. When your plants are one inch high, it will do well to scatter lightly, with the hand, wood ashes over them, as this will in a great measure keep away the fly and the bug. If the fly should appear, it would be well to water twice a week, with a solution of six parts water, one of wood ashes and one part lime, this will destroy the eggs, and not injure the plants in the least. When about three inches high, your plants will be ready for setting out. Always select the strongest, as you thin out the plants ; they will grow rapidly, so you will be able to plant out every two or three days. It would be well to have some mats at hand, so that you can cover your plant bed during the heat of the day. Your planters should bear in mind that the more care and attention they bestow on the plant bed now, the better will be their prospects for a good crop of tobacco hereafter. While seed is growing, it will take all the planter's time to get his ground into proper order to receive the plants, and he should be collecting all the refuse matter he can to burn, and scatter over the ground previous to his second ploughing, burnt wood or vegetable ashes, are considered about the best manure for tobacco, which requires a considerable amount of salts to be in the ground ; else it will not burn, or if it burns, the ashes will be black.

I have had considerable experience also in sugar planting, both in the United States and South America, and I was much surprised a few days since to hear the suggestion—plant only the tops of the sugar-cane, and put three or four in the drill together. You should carefully select your stalks, and place them evenly in the drills. It will be very little more trouble to do it properly, and then you will have a nice even drill. The late Baron Liebeg was a great advocate for poudrette as a manure for sugar-cane, and gave an example where he used night soil ; the produce was several tons per acre, over the yield of that manured with farmyard manure and city sweepings. It is a wonder to me, Sir, that your city authorities do not manufacture manure from night soil, and try and introduce it amongst the farmers. It could be manufactured at a low price, and would become a source of considerable revenue to the Municipality ; in America it is never allowed to go to waste, and freely sells at $50 or Rs. 100 per ton. The Japanese consider it the very best, and always use it in preference to farmyard or any other manure. As I am on the subject of tobacco, a few words regarding the manufacture of cigars, as made in Cuba and America, may not be out of place.

In the first place, you should select your leaf tobacco with care, and to do so you must exercise the senses of sight, feeling, smell, and taste. Select a thin, sound leaf, for the wrapper or outer cover ; try and get the leaf so that the wrapper can be cut from *between* the veins, and not across ; the inside or filler should be a light, or what is called trashy tobacco ; this tobacco is much more free from oil, or nicotine, than is a heavy thick leaf. See that your leaf tobacco is evenly cured and of an uniform color, and before purchasing, try it, and see that it burns to a white ash and fragrant smell. The night before the tobacco is to be worked, see that the tobacco selected for the wrapper is thouroughly moistened with soft water (it would be better to boil the water and let it cool) then roll it in a blanket or large coarse cloth ; by this means the wrapper becomes pliable and will not tear. See that your workmen do not wet the fillers too much, for in this lies the great fault with your Indian-made cigars. As soon as your day's work is ended and cigars counted, they ought to be spread in the sun for three or four hours and then cooled in the shade. Then you can pack them away in a large box, but if you tie up your cigars in bundles as soon as made, the damp filler and wrappers cannot dry; and the consequence is the filler becomes mouldy and ferments, thereby giving the cigar a bitter taste, and causing an unpleasant sound, like unto that of a wet or dirty pipe. Drying your cigars gives you another advantage, for you can place them in the market within a week, and they will have an appearance of age, and smoke well. Now, Sir, your Indian cigar-makers, as a rule, do not use the scrap tobacco (or clippings), but sell it to snuff-makers, at a nominal price, but in

America this is all used as fillers, and I believe it makes a better cigar, than that made altogether of long tobacco.

I have no hesitation in saying that Indian grown tobacco, if properly cured, is as good as any grown in America; for you can use nearly all the tobacco raised in India for cigar-making, whilst in America, the States only of, "Maryland, Connecticut, Delaware, and Florida", are capable of growing tobacco suitable for cigar fillers, and they are obliged to purchase Cuban tobacco for wrappers.

Hoping your planters and cigar manufacturers will use the few hints I have given.

A TOBACCO PLANTER,
OF EIGHTEEN YEARS' EXPERIENCE.

Madras, 9th September.

KOTEGURH NOTES.

TO THE EDITOR.

SIR,—The weather during the month has been unsatisfactory. There has been too much rain, on occasions very heavy, and owing to heavy and nearly continual mists, the sun has had no opportunity of making itself felt. The consequence is that the ground is thoroughly soaked, weeds abound in such profusion that it is impossible to keep cultivated plants clear from them. So much wet will damage the prospects of the hay crop.

The following is a comparative table of the past five seasons :—

	1875.	1876.	1877,	1878.	1879.
Rainy days.	17.	19	7	22	23
	First portion wet; latter dry.	First half very wet, preventing outdoor operations Second half pleasant.	Dry. Grass stunted in consequence.	Very wet. Grass growing in great luxuriance.	Very wet and misty, the latter quite hiding the sun. Summer crops drooping in consequence of too much moisture.

Light zephyrs, slight thunder and lightening, mornings misty.

The thermometer (fahrenheit) hung in an open verandah (6,400 feet above sea level) W. aspect, is about 66° in the morning, 69° in the afternoon, lowest 65°, highest 70°.

Upon the Hatú range hazelnuts are ripening, berberry shrubs covered with purple berries. An everlasting flower (*Matricaria* sp.) something like a chamomile; wild sweet pea, wild balsam, and Michaelmas daisy (*Aster campestris*) are in blossom. Lillies of the Valley gone out.

The young birds are becoming strong on the wing, and will be quite ready to afford employment to sportsmen next month (September) Crikets, grasshoppers, frogs, bats, owls, spiders, fishworms, flies, &c., &c., in abundance.

Food-grains have risen in price—red flour 8 seers, white flour 7 seers, barley 12 seers, urad 7 to 8 seers, gram 11 to 12 seers, table rice 5 seers, coarse rice 7 seers per rupee. Prices are expected to rise considerably owing to the projected visit of the Governor-General to Chini next month, as the tag-rag and bob-tail accompanying him will eat up all the produce near the line of march, like a swarm of locusts, and we are situated well within the influence of his march.

The villagers are busy cutting the weeds in their fallow fields; these weeds are cut with a long sickle (vern. *brasti*) and allowed to lie and rot for two or three weeks, after which they will be ploughed into the land together with the roots of the plants from which they have been cut. In this way the villagers obtain a first rate crop of mixed rotten and green manure, and if to this a thin layer of stable litter can be added, the outturn from the ensuing cereal crop will be 12 to 16 fold. So you see the natives understand something about manuring their crops—in fact if they were a little better off so as to be able to keep up the requisite number of cattle to supply their holdings with manure, the land would never deteriorate, they would be a happy race of beings not requiring to get into debt, or if they did so then only temporarily, as they could always count on a steady annual yield from their fields; now, without manure, their outturn decreases by slow degrees, until many of their fields have gone out of cultivation, simply through exhaustion of the soil. The native cultivator requires a little capital, and his only chance of obtaining it is by working for Europeans; where he can do this he is well off—*poor where he cannot*. And yet knowing this, the bureaucrats who are trying to govern India do their utmost to prevent European settlers coming to India, or when they are in India and are quietly endeavouring to make a home for themselves and their children, and dispensing money—for labor and materials—in their neighbourhood to the great benefit thereof, some bureaucrat will step in and endeavour to ruin him unless the European settler knuckles down to him after the manner of a native. The summer-sown crops are being weeded, and some of them will be ready for harvesting next month.

Walnuts, peaches, Cape gooseberries, and grapes are ripe; the former can be purchased from 12 annas to one rupee per thousand.

Tube-roses, dahlias, asters, and crocus-lily are charming.

Jerusalem artichoke in flower. Pumpkins, cucumbers, tomatoes, beans, cabbages in plenty. Melons were tried, but have proved a failure. That big pumpkin (named *maha kaddu* by the villagers) has attained a girth of six feet and is still growing; I ought to have mentioned that its seed was introduced by the Rev. Mr. Carleton, American Mission, Arni, Plach, Kúlú. Castor-oil seed was sown, but the plants are very stunted, due, in great measure to the dry spring; the seeds are forming.

G. P. P.

Kotegurh, August 31st, 1879.

The Indian Agriculturist.

CALCUTTA, OCTOBER 1st, 1879.

THE DRAWBACKS TO SUCCESS IN TEA.

II.

IN our remarks on this subject in last issue, we notified two of the drawbacks as European management, and Directors' Fees; the former we thought quite imaginary, and the latter only too real. We will now see whether any others exist, and the first we notice is :—

Managing Agents.—In what follows we would like it to be most distinctly understood that we have no individuals in our mind's eye as we write, it being the system we wish to speak of, as we are convinced that if the present agents were changed twenty times, the result would still be the same. There are two things concerning the agent which are objectionable. They are the amount he receives and the basis on which that amount is calculated, The amount he receives is of itself too high, many agents work for small salaries, but the majority draw large sums. It is impossible to arrive at a true estimate of how much an agent receives, as he takes care to keep the amount in doubt so far as reports are concerned. A report lies before us of a Company which last year made over 400,000lb. of tea, and which has a capital of over 8 lakhs. The amount charged directly as Secretaries' allowance, is Rs. 4,200, but it is impossible to tell how much of the heavy charges debited in the accounts go to the agent. We know he buys stores of all sorts, but we do not know how much the price of these stores is augmented by the commissions received either by the agent or by his sircar or banian. All these impositions are customary and patent to any one at all acquainted with the Calcutta style of doing business. The agent does not personally know the price of implements, and believes all his banian tells him, while the latter gentleman purchases them in most instances in the bazaar, at cheap rates, and hands them over to the agent at the prices charged by European houses.

Then as to the mode of calculating an agent's commission. He usually draws a fixed salary, which is grandly called an office allowance, then he gets a commission (commonly $2\frac{1}{2}$ per cent.) on the gross proceeds of the crop, and 5 per cent. on purchase of stores. The latter is comparatively trifling, but the former is a heavy charge, not *per se* perhaps, but indirectly, as the agent is encouraged by his interest (and we are all of us liable to be moved by self-interest) to insist on a style of manufacture which is simply ruinous to the good name of Indian tea. It has, however, the advantage, in the agent's eyes at least, of leading to a sale, and on that his commissions depend. He orders strong pungent rasping tea to be made, in obedience to the directions he receives from

his friends or constituents at home, who are interested in propping up the China tea trade as long as they possibly can. Self-interest is at the bottom of it all, and this will continue either till the tea companies become their own agents, or until the paid agent is remunerated by a certain percentage of the nett profits of any given year. This will ensure the work being carried on in the interest of the company, as under these new circumstances the agent's interests will coincide with those of the owners of the property he is looking after.

Method of Selling.—We have given this subject the most careful consideration, and have arrived at the conclusion that all tea should be sold in London.

There are many reasons for this, we will note a few. London offers a larger market, with more scope for open competition. The buyers here are comparatively few, and are as a rule well-known to the habitués of the Auction-room. A number of speculators attend the Calcutta sales, and buy up largely, with a view to shipping home for resale, and is it for a moment to be supposed that they would continue, year after year, to carry on this trade, if it did not pay them, truly the British merchant is not such a fool. It may be that a loss—a heavy loss—may follow now and again, but on the whole it must pay. Now whatever profit these merchants make would be made by the companies and more, for they would save sale charges here by shipping to London.

Again, we have closely studied the average prices obtained here, with those ruling in London, and allowing for freight and insurance, we find the London prices better. It is impossible it could be otherwise. Another error in selling teas in Calcutta is, that almost all qualities are forwarded to London. If the Companies had energetic agents whose business was wholly and solely to look after the tea interest, then lower classes of teas would not be sent home at all, but openings of which many exist, would be found for them here. We have often used these cheap broken teas, and do not find them so much inferior to Pekoes and Pekoe souchongs that their relative values should be so very much below the others. Good Pekoes and Pekoe souchongs realize now about 12 annas per lb. While these do not sell at much over 6 annas, and it is absurd to suppose that they are only worth half of the others. The real reason of this relatively low price is, that these teas, which will sell at cheaper prices at home than the others, have to bear an equal burden of freight and duty, and that they cannot stand.

Granting that the freight charges and duty amount to 6 annas per lb., this means 100 per cent. on the value here, while it is only 50 per cent. on the higher class teas. Hence it follows, that if possible, a market for these should be found here, and that there is a market, is evidenced by the fact that during the four months ending 31st July, there were imported from China, &c., 7,27,765lb. This was at the rate of over two millions of pounds per annum. This sort of business is too troublesome for the great merchants who superintend our tea interests. We do not speak sarcastically, their business is, as a rule, exporting and importing on a large scale, and we could not look to them, to undertake such a mode of operating. But this is just one reason the more why they are not the proper class to look after the planters' interests.

We do not intend saying a word on the broker or auctioneer, not because we have nothing to say, but because the subject has been discussed *ad nauseam*, and has practically been decided against the entire system, as being one which encourages the worst features of self-interest to interfere with the legitimate progression of trade.

We will only notice one more drawback:—

Financing.—The great majority of companies are being carried on with too small a working capital. This is fatal to success. To get over the difficulty, two methods are adopted. 1st by debentures, and 2nd by loans made by or through the managing agents. Very few adopt the former which is a commendable way of getting over a temporary difficulty. The great majority resorting to the second, which is by far the simpler of the two, but it is a costly remedy. Interest at the rate of 8 to 12 per cent. is charged, and generally sundry commissions fall in as a matter of course, but the most fatal part of the arrangement is, that it puts the company entirely in the hands of the agent. During the currency of the loan, the estates virtually belong to the agent, and he controls them according to his own sweet will. The true methods of getting over the difficulty are two.—Debentures, and the issue of more shares. If the embarrassment is temporary, debentures should be resorted to, and should be retired in full before a penny of dividend is paid to the shareholders. If on the other hand more capital is manifestly required to carry on the concern efficiently, more scrip should be issued. If the Company be properly conducted, there should be no difficulty in having this fresh capital taken up by the existing shareholders, and if this should fail, it is a pretty clear sign that there is something wrong with the Company's financial condition, and if it cannot get along without borrowing every year for the succeeding year's expenses, the sooner it gives up business the better. If the want is only of a temporary nature, there should be no difficulty in raising by debenture what may be required.

FARM WEEDS.

IT is now more than twenty years ago, since Professor Buckman, of the Royal Agricultural College, Cirencester, wrote that essay on agricultural weeds, which, so far as Britain is concerned, all but exhausted the subject, and rendered it a difficult matter for anyone dealing with the same topic, to do much more than echo what had already been said. During this interval of twenty years, a marked improvement in agriculture in all its methods and branches has come about; so that "dirty" land, land overgrown with weeds, all but overmastering the crop, is an occurrence met with, we should say, but rarely in Britain. The farmer of to-day fully realizes that weeds not only take up space on his land that ought to be occupied by paying crop, but that they also use up the plant-food which might have gone to the building up of his crop in greater strength and weight; besides, the cost of weeding is an item of considerable importance. The vegetation that would naturally cover a soil, were it left to the forces of Nature, without the intervention of man, plays a very important part in gathering plant-food from earth, air, and water, and storing it up in an available form in the soil that yearly grows in resources and wealth. When the forces of Nature have been at work for generations in the formation and enriching of soils than man comes, and interferes so far with Nature's operations, that he substitutes a crop of his own, for the variety of Nature's selecting, and what was hitherto restored to the soil, he carries off in the form of bread, beef, wool, and beer, and the more of these and other products he can get out of the land without permanently injuring its fertility, the better for himself. The plants which were of so much importance in Nature's arrangement for building up the resources of the soil men look on now, not as friends and allies, but as so many intruders and disturbers of their arrangements, to be hunted out and destroyed, to make room for the utilitarian.

Worthy George Sinclair, gardener to his Grace the Duke of Bedford, in the "Weeds of Agriculture" added to the fourth edition of his "Grasses," solemnly affirms that weeds are a special contrivance of Providence for "perpetual exertions" on the part of man, a stimulus to "better habits and more active industry;" and that without weeds, lands would go out of cultivation (see page 323-4, Sinclair on Grasses). Nowadays, men are not so apt to mingle dogmatic theology with causes and results, which can give a very

good account of themselves without postulating a Providence devising and interfering at every stage. Sir John Sinclair of Thurso, who was mainly instrumental in founding the Board of Agriculture in 1793, of which he was President for 13 years, and who during a long life of ceaseless activity, wrote and published pamphlets and books on all sorts of topics (it is said 367 in all,) dealt with weeds in his "Code of Agriculture." In 1806 there was published in the fifth volume of the communications to the Board of Agriculture, an essay on Weeds by Mr. Pitt of Wolverhampton, Mr. Pitt was more of a botanist than an agriculturist. Later on, Mr. Holdich of the *Farmer's Journal*, a man whose knowledge of farming was extensive in his day, had, before his death, all but completed an essay on this subject, which passed into the hands of George Sinclair, was published separately, and afterwards embodied in the fourth edition of "Sinclair on Grasses." Since then Professor Buckman's essay which appeared in 1856, is perhaps the most notable contribution to the subject.

Samuel Johnson, the Lexicographer, whose knowledge of Latin and Greek roots was much more extensive than his acquaintance with what agriculturists call roots, happily embodied the popular idea of "weed" when he defined it, as "an herb, noxious or useless." In the book of the farm, Stephens says, "when any plant is found growing where it should not be, it is a weed." Morton, "Cyclopædia of Agriculture" says "every plant different from the crop and growing with the crop to its hindrance, is a weed." In this view, every indigenous plant, and every cultivated one may in turn become a weed. The shed seeds of one crop may hinder the growth of succeeding ones ; and call for removal.

The farmer then finds plants of various kinds indigenous and cultivated growing among his crops, these he must keep in check and eradicate, if he can, if he is to gather the full measure of the benefits stored up by the forces of Nature in the land. It sometimes happens however that for want of some knowledge of Botany, or a deficiency of the power of exact observation, which a study of natural science tends to foster and mature more than most studies, his efforts to get rid of some weeds help materially to increase their number.

The coltsfoot (Tussalago farfara) a common enough plant in Britain, that golden yellow flower with slender scaly stem, which in early March, lights up every heap of rubbish, marley slope, railway cutting, and many fields, with its star-like blossom, contains on an average 150 seeds to every flower head. Every one of these seeds may, under favourable circumstances takes root and produces its kind, becoming in turn a root, bearing many flower heads. The flower heads of this plant never stand erect till the pollen is matured ; and as soon as the flowers have been fertilized, the flower head droops and thus preserves from rain and dew and frost the embryo seeds, until they are furnished with their curious downy appendix, so admirably suited to carry them along on the wings of the slightest breeze.

Plants like the coltsfoot, the dandelion, the thistle and others belonging to the same natural order *(compositæ)* endowed with much fecundity and vitality, are wafted yearly over all the land. The roots of coltsfoot are cut to pieces and dragged about by the harrow, to begin in new spots the work of reproduction, so with couch grass. Bulbs of the common garlic (*allium vineale*) reproduce the plant in amazing numbers. The importance of endeavouring to kill out weeds in their early development, before they have reached maturity, is perhaps not sufficiently realized in practice. Annuals or biennials may be effectually got rid of by cutting the plant at any time before the seed has arrived at maturity. This process of cutting down when the plant is young, before it takes a proper hold of the land, will in the end prove much more economical than having afterwards to be at considerable cost for weeding.

The fecundity of some of the commoner British field plants almost exceeds credibility, and this added to the difference in the times of their flowering and running to seed, and the fact that in some cases in the same plant fresh branches may be putting forth new flowers when others are bearing ripe seed, render their destruction a matter not to be accomplished at once.

The following catalogue is drawn up from several hundred observations made over five years in different parts of England, and includes a variety of Geological formations and various methods of farming. The list first appeared in *The Quarterly Review* of October 1859. We believe it may be new to most of our readers : and it contains the results of patient painstaking observations. Observations of a similar kind on the commoner and most troublesome weeds of various parts of India would be as valuable as they would be interesting.

Table of the Fecundity of Weed-plants.

Common Name.	Botanical Name.	Number of seeds to a single plant.	When gathered.
Black mustard ...	*Sinapis nigra* ...	8,000	August 17.
Charlock ...	*Sinapis arvensis* ...	4,000	September 18.
Shepherd's purse ...	*Capsella bursa-pastoris.*	4,500	September 19.
Hedge mustard ...	*Sisymbrium officinale* ...	5,400	October 18.
Cow parsnip ...	*Heraclium spondylium.*	5,000	August 17.
Fool's parsley ...	*Æthusa cynapium* ...	6,000	August 17.
Red bartiza ...	*Bartsia odontites* ...	4,800	October 1.
Dandelion ...	*Leontodon taraxacum* ...	2,040	September 10.
Niplewort scabious ...	*Lapana communis* ...	8,400	September 23.
Hardhead scabious ...	*Centaurea scobiosa* ...	4,000	September 10.
Stinking chamomile ...	*Anthemis cotula* ...	40,650	September 23.
May weed ...	*Anthemis arvensis* ...	45,000	October 14.
Burdock ...	*Arctium lappa* ...	24,520	October 1.
Sour thistle ...	*Souchus oleraceus* ...	19,000	October 1.
Groundsel ...	*Senecio vulgaris* ...	6,500	September 10.
Musk thistle ...	*Cardus nutans* ...	3,750	October 13.
Corn cockle ...	*Agrostemma githago* ...	2,940	September 8.
Common campion ...	*Lychnis dioica* ...	3,425	October 1.
Common dock ...	*Rumex* ...	13,000	September 15.
Red poppy. ...	*Papaver rhœus* ...	50,000	October 19.

The sources whence weeds are propagated and distributed may be classified under three heads.

1*st.—Indigenous plants* which vary with the district, the soil, and the method of cultivation. These are more or less reducible to a minimum by careful cultivation.

2*nd.—Weed seeds* are scattered by natural agents, such as wind, bird, &c., from manure heaps, road-sides, uncultivated ground, railway-cuttings canal-banks, lanes, hedge-rows, &c., strict attention to waste land, pastures, and commons ; cutting frequently whatever would prove troublesome, before it runs to seed, tends to lessen the evil from these sources.

3*rd.*—A third source is *foul seed.* There are always in existence specimens of humanity who find it profitable to adulterate. Most articles of sale are subject more or less to adulteration. In some cases it may be trifling, in others it is so great, that the genuine article forms but a fractional part of the whole compound. It is not such an easy matter nowadays in England at least, for unjust dealers to palm off on farmers either inferior manures at high prices, or crop-seeds deliberately adulterated with weed seeds. It is to the interest of the respectable dealer to supply the best article at the price which may secure for himself a reasonable profit. And the British farmer has now no difficulty in securing a fairly pure and genuine article guaranteed, if it be a manure, by some practical chemist to contain certain substances in certain proportions if crop-seed, then the guarantee of a professional Botanist is surety for the farmer having what he pays for. To what extent crop-seeds were deliberately adulterated in Britain twenty years ago may be gathered from the following table :—

Table of Weed seeds to the Bushel of Crop-seeds.

Name	Weed-seeds to the Bushel	Remarks.
Italian rye-grass ...	204,800	Imported seeds usually dirtier than home grown.
Ditto imported ...	459,560	
Perennial rye-grass ...	345,860	
Ditto imported ...	433,080	
Mixed seeds, rye-grass, and clovers ...	3'2,820	Mixed seeds are generally very foul
Ditto imported ...	537,600	
Meadow foxtail ...	84,480	Grass seeds are usually mixed with weed-grasses, which weigh heavier than the genuine seed.
Cock's foot ...	768,800	
Sheep's fescue ...	167,680	
Hard fescue ...	294,401	
Sweet vernal ...	102,400	
Crested dog's tail ...	409,600	
Linseed ...	304,640	Both for sowing, and cake finds its way to market in a very foul state.
Mean of six samples of cow-grass clover ...	401,066	Clover seeds have been offered for sale, in which half the weight was made up of weed and bits of stone and dirt.
Red clover ...	728,833	
Dutch clover ...	2,768,106	

We shall esteem it a favour if any of our numerous readers would note the weeds that may be most common and troublesome in their district. Their times of seed-bearing, and whether they are indigenous or introduced, and how introduced. Any note on this subject, or on the adulteration, natural or deliberate of seed for crops, we shall be glad to give the fullest publicity to.

MODEL FARMS FOR BENGAL.

(Communicated.)

THE subject of "Model Farms" appears to be taken up in right earnest by the Governments of Bombay and Madras, and it is perfectly surprising to see how those Governments, subordinate though they be, open out their purse-strings when any scheme bearing on the agriculture commerce or productions of the country comes into question.

2. Captain Coussmaker had a great idea of tusser cocoons, and wrote a lot of nonsense about them, and the Madras Government at once handed over to him two or three thousand rupees to aid him in his researches, *i.e.*, in finding out after three years of trouble and waste of time, what any one in Bengal might have told him, *viz.*, that the tusser worm thrives best in the open air and requires no domestic attention in the way of roofs, baskets, &c., &c., to make it comfortable.

3. Another man gets hold of model farms as a "hobby horse," and about a lack of rupees are launched out in buildings, laboratories, material, &c., for the purpose of teaching a dozen or so of "Pillays," "Moodylays," "Swamees," &c., a "Mountain" of science, than passing them through—"300 examinations," (hear it ye Civil Service Examiners,) keep them at Government cost, to teach people who cannot read or write, what they do not require, cannot afford to carry out, and will not learn!

4. While the expenditure of Government money on such scientific institutions is to be deprecated. The idea of having Government Farms is nevertheless a very good and laudable one; and if the Government would only take away from the farms their highly scientific character, and at a very much less cost, give to the cultivators of Bengal, Government farms in each district, where they could learn the style of cultivation that would suit best their means and condition, and from whence they could procure vegetable seeds new to them, food grain seeds that they might wish to introduce in their villages, fruit tree grafts, and such other items at a fair cost without yielding a loss to the farm, as also obtain practical instructions how to manipulate the various agricultural products that may be new to them, and that would pay them, &c. Such farms would be capable of doing a great deal of good; and hereafter, as the country rises in its general agricultural education and needs, they could be made to dispense a higher and more scientific class of agricultural instruction till it reaches the "Sydapett Standard."

5. To place matters in a more practical manner, I will take as an instance the district of Rajshahye, in Bengal. In this district the "Indian corn," or "maize," "bhoottah" is virtually unknown to the ryot. Here and there, few and far between, where an emigré from the N.-W. or a "boonah" from the jungles of Chota Nagpore, has his abode, a field of "bhoottah" may be seen, but not otherwise, and on my showing "bhoottah" cobs to some of the *chassas* in the eastern portion of the district, I was asked what was to be done with it? Is it eaten?

6. I have grown Indian corn in my garden in Eastern Rajshaye all through the year, but as I watered the crop during three out of the twelve months, and the ryots will not do so, they will be able to grow it for about eight months in the year. The Indian corn is a very paying crop, the corn can be eaten, the steams yield *goor* (treacle) and the leaves are good fodder for cattle.

7. Another crop that grows to perfection in Bengal is the arrowroot (Maranta Arundicinea.) It requires no trouble beyond what the *huldee* turmeric (grown very largely in Bengal,) does and yields enormously. I have obtained over 60lb. of pure arrowroot powder from a plot of ground a little less than the twelfth of an acre in area. This plot had the year before borne a crop of arrowroot; and I had neither manured it, nor taken any extra trouble about it. So that the yield may be taken as a fair and ordinary one. Taking the market value to be even 6as. per lb., the acre would produce 6as. × 60lb. × 12 = Rs. 270 less cultivation and manufacturing, &c., say Rs. 100, leaving Rs. 170 to the good, or Rs. 50 per beegah besides the seed.

8. I heard a man in the Civil Service who was discussing this subject with me once, urge "Oh! the arrowroot from the East Indies has no market value in Europe," and even in the London price current for August last there is no value marked against it. But I can account for this. In the younger days of John Company, East Indian arrowroot was exported to some extent. Now *that* arrowroot was the stuff procurable in large quantities in some of the Indian bazaars under the name of "Tee-Khoor;" produced by the natives from the roots of various jungle plants of the "Curcuma" family, *viz*, "Curcuma Augustifolia," "Curcuma Leucorhiza," &c. This production was obtained in a very careless manner and contained many crude substances besides arrowroot. As a result it was soon found to be inferior in purity to the article obtained from the West Indies, from the roots or tubers of the "Maranta Arundinacea" under the careful manipulation of experienced and doubtless well-to-do manufacturers. Pure starch cannot be very different whether it come from the West or East Indies, and if the East Indian Government will only have the East Indian arrowroot properly analysed, and make public its analysis in Great Britain, that article will very soon hold its own against every other country. Bengal could grow thousands of tons of arrowroot, and it would be used largely by the poorer classes who are notoriously fond of starch food. As matters stand, the ryots cannot procure seed tubers, they do not know now to manufacture the article, and are quite ignorant of its uses, and it is the same with a hundred other different items, that only require to be placed within reach of the Bengal ryot to be grown and to be utilised.

9. The Bengal ryot is a peculiarly Conservative creature, he has certain grooves, old grooves, in which his ancestors before him ran, and in which he runs. Place anything before him on those grooves, and he will run on with it like a fiend, but do otherwise, take him off his old groove, and you have an apathetic, indolent, stubbornly inert, valueless "cuss." Thus, I once was speaking to an intelligent ryot who cultivated about 30 to 40 acres of ground about growing fodder for cattle. "Cattle fodder!" he cried, looking at me with a most comical expression of amused astonishment. "Grass for cattle to feed on?" "Why sahib would it not be cheaper and easier to sell the cattle than to grow the grass?" "No, it is God's work to grow the grass, and the cattle are the 'Shaitans' that are always destroying it, and feeding themselves on it." "It is useless to grow grass for cattle!" Now, here spoke the "*pucca* Bengalee" according to his conservative ideas. His groove has been never to grow fodder for his cattle. Why will he do so now? And he will not do it for generations to come. Now what good will it do to pour Geology, Chemistry, and all the other "ologies" on such creatures? No good at all, and apart from that, the common class of Bengal ryot has just sufficient means to keep body and soul together, where will he find means then to expend money on scientific aids. The poorer classes of ryots eat food that a sahib in decent circumstances would not believe good enough for the subsistence of his dogs; and these are the men who are to attempt subsoil drainage, deep ploughing, chemical manures, &c., &c.

10. The Government has very little idea of what is grown in each district, or how it is grown; and no sooner is information on any agricultural product required, than a committee is deputed to procure it, and the result is information hastily gathered, that is crude, common place, and not to be relied on.

11. If the Government would take about forty to fifty acres of land (on rent,) in each district, choosing an old indigo factory or other old building for the dwelling-house, and start farms in Bengal, it would by doing so, lay the foundation of a very useful and beneficial department.

12. Useful, because through the records of these farms a vast amount of valuable information ought to be forthcoming. And beneficial because through the aid of those farms the common agriculturist will be able to learn what is done in other districts; in the way of tilling the soil; he will be able to procure seeds, grains, plants, and other materials such as medicines for cattle disease, &c., at a fair rate, and also be

able to consult with a man of better knowledge on very many points regarding which he may require information, &c., and lastly, the Government will procure information from their farm managers of a political nature when necessary, which at present it cannot do, because it has not got any subordinates in the mofussil who have not some official status, and such men can only see the Bengal ryot through their "official spectacles" and then only see him with the "moral armour" that he dons, as soon as he suspects he is being looked at by a Government servant who has the power to punish him in any way.

13. While advocating Government farms, I do not advocate farms placed under "farmers" or swell agriculturists trained in England, or Germany, or anywhere else. Like our swell staff and people in the Forest Department, who at the end of the year send in a report of a few roads made, poor people found trespassing in the jungles prosecuted, and fires put out. What the Government ought to do is to procure men, gentlemen, who know the country, and the people, can talk to the people in the *chasha's* language. Who have a fair knowledge of Geology, Chemistry, Botany, and Meteorology, who can draw and draught, who have had agricultural experience in Bengal, who know something about cattle; such would be the men to place in charge of the farms. Men who, not being professionals would not sit idle watching for the result of certain experiments as professionals do, but would put their hands to everything agricultural, move about the district, keep up a correspondence with other Government farmers, see what the ryots produce, help them to get what they have not, keep up a set of tabulated books for future reference of the barometric pressures, the thermometric figures (of some moment), terrestrial magnetic experiments to match, notes of rainfall and weather, effects of rainfall on soil and rivers, effects of rainfall on soils and crops. Manures used, effects of manures. The Government farmer would also keep up a good fruit and vegetable garden, and supply seeds and fruit plants, &c., in other words give his time and attention to his district as if it all was one huge farm belonging to the Government under his care; and his head-quarters was the place whence all information and advise would emanate and knowledge of the country be procured and come in.

14. When the Government have after a few years found that the people begin to look upon the farms as necessary institutions, and the information gleaned by the Government farmers has been reduced to a standard, there will be some date whereby to judge of the wants of the country, and then if there is a necessity for it, grand institutions like the Sydapett farm could be started.

15. Doubtless there will be many who will cavil at the above suggestions, and others who will laugh to scorn the project of starting farms under other than properly trained farmers. To such I say look at the "Forest Department" what is it doing? simply nothing. Young men have been sent to learn forestry. In it there is a large staff of well paid officials, and what is the result, simply nothing!; and why, because the officials know little or nothing about Indian jungles, and how to manage them. They believe there duty is to fight every human being who approaches the jungles, and the result is, he has his jungles to himself, and he may keep them or eat them, but make an income for the Government out of them is next to impossible for him.

16. If anything were required to shew how little the forest officers understand the Indian forests, it is there opinion as regards the fires. The fires in the Indian forests are of the utmost benefit, the burnt leaves and charred wood, supply manure to the trees, and the smoke and flames destroy myriads of vermin that injure the leaves and plants, nevertheless the great duty of our foresters *mirabile dictu* to prevent fires!

I see in the last *Calcutta Gazette* a meagre report of the operations of the Forest Department for the year, and one item in it struck me as positively laughable, it was that in the Palamow district the Government had hundreds of square miles of forest that did not pay. Now if the Government will simply help the jungle people with seed and food, and get them to rear tusser cocoons in those jungles, the result would be very different; the Government would instead of a loss obtain an enormous income out of them. But of course the swell young foresters highly trained doubtless never learnt anything about tusser among the oaks and chestnuts where they were trained, and they know nothing about it, and so with Government farms. If trained agriculturists come out and "300 examinations" per man is the order of the day such farms are not needed at all, otherwise they are, and the sooner they are started the better.

17. The Government farmers could be placed under the orders of the Collector of the district, and the Government analyst (not a man like Mr. Pedlar who to my knowledge analysed some tobacco leaf and as part of the chemical analysis, gave "48 per cent. of cellular tissue" charging a gold mohur for his trouble), could attend to their wants until such time as the work became heavy, when a special analyst would be necessary for the department.

18. Suppose the Government were to open out six such farms, placing them under three "Sahibs," two under each man. The cost of it all, with rent for land, &c., would not be over Rs. 40,000 or 50,000 for the first year, at most, and if nothing else results from the outlay, the series of magnetic, thermometric, and barometric observations, together with their accompanying crop and agricultural reports, will be well worth that money.

19. To put my ideas into practise say:—

			Rs.
3 Government Farm Supdts., @ 500 each 1,500 for 12 months	...	...	18,000
6 Writers to keep accounts, &c., at 30, 180 for 12 months	...	...	2,160
6 Chowkydars @ 6 per month, 36 for 12 months	...	...	432
18 Farm hands @ 5 per month, 90 for 12 months	...	...	1,080
Rent for 300 acres say ...	...	...	1,000
Office charges Stamps, &c., @ 3, 18 for 12 months ...	...	...	216
Travelling expenses 48 per man, 144 per month, 12 months		...	1,728
		...	25,376
Cultivating, seeds, &c., say Rs 6 per acre per year	...	...	1,800
		...	27,176
Implements, books, office furniture, chemicals, &c., &c.		...	6,000
Buildings, repairs, &c., out-houses ...	...	...	9,000
Total Rs.		...	42,176

Of course the following season the outlay will be less by Rs. 6,000 expended the first season on implements, &c., &c., and there will also be an income of some extent to further reduce the expenditure But at the same time the farms would have to be supplied with strains of good cattle, sheep, and goats, so as to be able to add that great benefit, improving the breed of the live stock, to the other benefits that they will dispense among the Bengal ryots.

The Government could in connection with these farms organise agricultural exhibitions every quarter, at which small prizes might be distributed, and at the end of each season, a district agricultural exhibition could be held so to enable the Collector to judge of the progress made by, and the interest evinced in the undertaking by the ryots.

EDITORIAL NOTES.

On account of the uncertainty that exists as to the crops at home, and the present crisis that has arisen in England regarding the rent of farm lands, the wheat supply question has come to the front. All countries are striving to grow this cereal in order to help in supplying the eleven million quarters which the United Kingdom now requires from outside, and which want will be much increased shortly, as less and less is being sown year by year. However 11,000,000 quarters equal about seventy millions of maunds, or at the rate of production in India, to the entire crop of seven millions of acres.

Wheat growing is steadily increasing in New Zealand. From the "statistics" of that colony for 1877, we find that the crop which was 4,054,377 bushels in 1876, had risen in 1877 to 6,336,369. This latter crop was raised from 243,406 acres, being at the rate of 26¼ bushels for acre. This is about double the quantity produced for acre in India, and if we are to compete at all with such a fresh and virgin cultivation, it behoves us to give our attention to the steady improvement of the soil.

We have been favoured with a copy of the British Burmah Administration Report for 1877-78, from which it appears that the province is keeping well in the front as regards agriculture, there having been under cultivation 2,951,265 acres, as compared with 2,833,520. The increase is as usual almost entirely in rice.

although other miscellaneous crops were not forgotten. The system of *Jhoom* as carried on in the hilly parts of North-Eastern Bengal and Burmah, does immense damage by reason of the fires which usually accompany it, and it should be prohibited with a strong hand.

THIS *Jhoom* is carried on in this way. A dozen families select a site in the forest on which to commence operations, they begin by setting the forest on fire, for the purpose of clearing 40 or 50 acres, but as they pay no regard to the direction of the wind, chance, and the breeze direct the flames, and as often as not several hundred acres are burned, on this soil, which is rich and virgin, they sow their crops, and this they continue doing for a few years.

WHEN the soil shews signs of declining power, they move off elsewhere and repeat the operation. By this process valuable forests are destroyed and no proportionate gain secured.

THE people of Burmah are taking a leading part in instituting agricultural shows. These ought to have good results, and are becoming popular among the cultivating classes.

DR. FORBES WATSON'S report on Indian wheat in an exceedingly interesting document, and tells us many things we did not know sufficiently well before, for instance that a very large proportion of Indian wheat was of a high class, but by being so much mixed with other classes, other grains, clay, and other foreign substances, the value of Indian wheat in England was much lower than it ought to be. We are also told that this high class wheat is not confined to one district, but is pretty evenly distributed over the principal wheat-growing districts of the land. We are told that the total production is 40 million of quarters, and as this is based on a production of about 13 bushels per acre, the home production being double of that quantity. The annual demand for wheat from abroad for the United Kingdom is 88 million bushels, and we imagine that India might make an effort to supply the greater part of this.

THE Government Botanical Gardens of Saharunpore and Mussoorie seem to be doing good work. The former especially is properly carried on, and the results are highly satisfactory. During the year ending 30th June 1879, there was distributed no fewer than 5,043 young fruit trees, as these were most probably for private gardens, they must work a change in the appearance of our gardens and compounds in a few years' time, why is not more done in this way in Bengal. This latter province seems to be standing still almost in agricultural and horticultural affairs. Besides these fruit trees there were distributed 39,250 strawberry plants, 2,625 timber trees, 9,348 flowering shrubs, 10,000 agave plants, and 13,937 packets of seeds which is surely a good year's work. The money loss on the year's working on Rs. 22,144, and we are glad to find that a pecuniary profit is not considered a *sine qua non* in the working of these gardens.

EXTENSIVE experiments in cotton were carried out in the year 1877-78 in the Punjab, and we have now the report before us. It does not seem that great success has followed these efforts, as the average outturn per acre has been 58lb., while 600 to 800 is not an uncommon production in America. The average local value of the outturn was Rs. 19-13-10 per cwt., which amounts to Rs. 9-15-5 per acre, and this as a gross revenue is manifestly too low for the rayat. It may be true that that year was an exceptionally unfavorable one, but it unfortunately happens that such years are becoming the rule rather than the exception. The highest outturn was 130lb., and the lowest 10lb., representing gross incomes of Rs. 23-0-11 and Rs. 1-12-4 respectively. It seems almost a waste of energy and of money to encourage the growth of an article which does not pay, when there is ample scope for the production of others which do.

WE are sorry to have made a mistake in our last issue by connecting the Nagpore Model Farm with the Agri-Horticultural Society. It appears they work quite apart, and that while the society may legitimately turn its attention to the introduction of exotics, &c., the farm has all along been more taken up with more purely agricultural operations and experiments.

We are pleased to hear this, and trust that the remarks we made in our last issue may not conduce to any invidious comparisons being made between the working of that and other Model Farms, we highly approve of these attempts to improve cultivation, and know that the Nagpore Farm is second to none in this respect.

THE trade of the port of Chittagong expanded very largely during the year, the returns showing a total increase of Rs. 20,07,324 in the value of the trade. This is chiefly due to the jute exports which were more than double those of the previous year, amounting to 318,517 cwts., valued at Rs. 19,63,170, as against 141,428 cwts., valued at Rs. 7,70,000 in 1877-78. The other exports consisted of paddy, rice, tea, and tobacco. The exports of paddy and rice increased from 401,199 cwts. in 1877-78, to 596,623 cwts. in the past year. The quantity of tea exported was 607,388lb., of which 86,265lb. were shipped direct to England. The total outturn of the season is said to have amounted to 690,925lb. Notwithstanding the increased prosperity of the port, its trade cannot yet be regarded as established on a stable footing. Of the articles composing the exports, only tea and a small portion of the rice are the produce of the district itself, the whole of the jute and the greater part of the rice being brought from other districts of Eastern Bengal. Thus, any change of circumstances, making it advantageous to the firms now engaged in the rice and jute trade to send their stocks to Calcutta for shipment, might reduce the trade of Chittagong to insignificance. There appears, fortunately, to be no reason to believe that such a change is impending.

COMMUNICATED AND SELECTED.

THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND AT KILBURN.

THE important meeting of this Society, whose labours and objects are so intimately identified with the material and industrial development of our country, are always a matter of national interest; but various circumstances of an exceptional character have attracted special attention to that just held at Kilburn. Its close proximity to our overgrown metropolis was in itself a noticeable feature, bringing as it did, the inhabitants of London into more immediate and instructive contact with the useful and ingenious agricultural and mechanical developments which have so greatly contributed to the progress and prosperity of the English people. It must be admitted that those who had charge of the details in connection with the Kilburn meeting made energetic and praiseworthy efforts to render it worthy of the occasion, and the countenance of her Majesty the Queen, and his Highness the Prince of Wales was not wanting to give it the august sanction of the Throne. But it is given to mortals to deserve, not to command success. The elements were unauspicious. So to speak, old and established precedent fully justified the official direction of the Royal Agricultural Society in counting with confidence on sunshine in July, even in England where we are said to have plenty of weather but no climate. It is unhappily notorious that such anticipations have been in this case sadly disappointed. We are told that the " rain, it raineth every day." During the meeting at Kilburn, this saying has been literally verified, not simply as applied to the " wide wide world," but in a strictly local sense. Indeed, were it not that the rainbow, with its coat of many colours, now and again gave us kindly assurance that we need not fear, not unreasonable apprehensions might have been entertained that the time had come for another deluge. Under such conditions it is not surprising that the site selected for the exhibition was reduced to a sort of muddy waste, through which it would have been quite impracticable for visitors to have made any progress but for the hurdles and means adopted to make perambulation possible ; and it is another proof of the laudable desire of the Royal Family to promote and encourage associated and private enterprise that they should doubtless at much inconveniences, have personally inspected the " Show " at Kilburn. However, in their case, virtue was rewarded, for they must have seen much that well repaid them for any trouble they may have taken. It cannot be denied that the " Show " at Kilburn (weather excepted) was the best, as it was undoubtedly, looking to the extent of ground covered, the largest ever held. Many acres of land were occupied by the tents and stands of exhibitors ; and, notwithstanding every drawback, the numerous visitors must have felt that they witnessed a sight not to be seen twice in a life. We could not, of course, in a limited space, mention everything that merited observation ; but we may specially allude to the remarkable display made by Messrs. J. and H. Gwynne, the great hydraulic engineers of Hammersmith and London. Our attention was attracted to their " stand " by the concourse of spectators who surrounded it ; and we are not sorry that we were induced to

particularly examine the various pieces of machinery exhibited. We found some of their well-known engines at work, discharging water into [illegible] temporarily erected to receive the aqueous tribute, yielded in such volume as can only be adequately conceived after ocular inspection. The engines moved with surprising velocity, yet with still more surprising smoothness. One of these, to which the name of "Invincible" has been given, deserves particular notice. There were several sizes of this machine on the ground, which, though of comparatively recent invention, has already achieved a cosmopolitan reputation. The "Invincible," we may state, is a centrifugal pump, furnished with every modern improvement, and is confessedly the best in the market. It is, however, especially valuable for use in countries where fuel is expensive or skilled labour difficult to obtain. Its mode of raising water is very simple and efficient, it is easily transported, and can be erected without the assistance of experts—a matter of great importance. In addition, it is very durable, not liable to get out of order; and in point of economy, utility, and power, the "Invincible" is also unparalleled. Some further details may be of service to our readers. We may remark that the pump is so attached to the bed plate, that the suction and discharge pipes can be swivelled at any angle by adjusting four bolts. The casing is so constructed that the disc and spindle can be inspected, cleaned, or removed, and replaced without disturbing either the suction or discharge pipes. The bearing surfaces are all very large, and are easy of access for adjustment. All the forgings are of the best steel, and the finish is not to be surpassed. Each engine is fitted with starting valve, condensed water-cocks, impermeator, lubricator to each bearing, and a complete set of case-hardened spanners. The engine can be disconnected from the pump in a few minutes, and worked as an independent engine. This arrangement has been largely used by contractors and for irrigation, circulating the water in surface condensers, also in salvage operations. Messrs. J. and H. Gwynne exhibited other excellent specimens of their machinery, amongst which we may mention two beautifully-designed and highly-finished vertical engines and boilers, which elicited admiration from every one who looked at them; however, we must candidly confess that our attention was almost exclusively concentrated on the "Invincible."

SUNFLOWER CAKE FOR CATTLE.

PROFESSOR BERGSTRAND, of the Royal Agricultural Academy, publishes a most laudatory report on the virtues of sunflower-seed cake as food for cattle. He states that it presents a remarkable constancy of composition, rarely, if ever, met with in other cakes, as met with in commerce. It contains from 13 to 16 per cent. of fat, and 35 or 36 per cent. of protein substances, and has, therefore, a nutritive value far above that of most ordinary feeding stuffs; besides which it has a most agreeable taste, and is altogether free from bitter or any injurious matters. Some careful experiments on its effects upon milch cows have been made at the Ultuna Agricultural Institute by Baron Akerhjelm, which tend to show that it both improves the quality and increases the quantity of their milk, the butter from which is also of exceptional excellence. Many practical farmers in the neighbourhood have also made trial of the same food, and are unanimous in their favourable verdict. Their milch cows all took greedily to the cake from the first day it was fed to them, and in all cases an improvement in the quality of the milk was quickly noted. For draught oxen and fattening bullocks also it is equally suitable, especially for the latter, whose meat presents an unusual richness of flavour when thus fed, and it may be given in small quantities to horses with much advantage, mixed into a thick mash with chaff. In comparison with other feeding stuffs this cake is very cheap, and it can be given in larger quantities than most other cakes without any ill effect. It is also particularly free from foreign matter, as there is no difficulty in gathering in the crop of seeds without adventitious admixtures. It should be remarked however, that experiments with this cake undertaken in Germany some few years ago gave far less satisfactory results than those reported in such eulogistic terms by Professor Bergstrand.—*Country Gentleman's Magazine.*

CULTIVATION OF GORSE.

ON the Continent, as in England, the cultivation of gorse (*Ulex europæus*) in waste places, as a food for cattle, appears to find advocates among a certain section of agriculturists. At a recent meeting of the Pritzwalk Agricultural Society, M. Ewers gave some particulars of his experiments in the direction of the Vorbeck domain in Pomerania. He found in gorse a plentiful supply of green food for his stock from September to May, even in the depth of winter, when snow and ice were masters of the situation. Milch cows, oxen, and sheep all ate it readily, and even greedily; and in the case of the first-mentioned animals, the quality of the milk was exceptionally good. The general results obtained were so favourable, that M. Ewers' stockman declared he would rather have to give up oats than gorse for winter feeding, the animals making flesh upon this diet in an altogether unprecedented manner. The crops were grown upon a barren sandy soil, of no practical value for any other purpose, and, with the slight addition of 3 bushels of compost manure per morgen, the yield was as high as from 200 to 300 cwt. All the plants were grown from seed obtained from France, that being of a better quality than the English, while in Germany it rarely ripens thoroughly, and is consequently of little use. The precaution must be observed of sowing new seed only, for it loses its power of germination when more than one year old.—*Country Gentleman's Magazine.*

CHARCOAL APPLIED TO HORTICULTURE.

NOVEL as the heading of this paper may appear to the tyro, yet its application, especially with regard to the artificial cultivation of plants, is as ancient as the pot culture of plants. Valuable hints, however, often fall into abeyance in times like the present, when some growers suggest that the use of drainage in flowerpots is a fallacy, and that glazed pots are quite equal to the porous material to grow plants in successfully. In nine cases out of ten, plants perish more on account of plenitude of water than from the want of it; indulgence is through the belief that every plant requires its daily modicum of liquid, and hence their wonder that the foliage turns yellow, a sure prelude to the death of the plant. Many amateurs might also plead guilty to a like charge were they so willing; failing which, they attribute unhealthy appearances to other causes wide apart from the true one.

The introduction of small knobs of charcoal to the potting soil would tend much to purify any stagnant water that might be retained in it. As plants are supposed to be carbon-consuming, the theory might be put forth that, even were the drainage perfect, a fair mixture of charcoal would materially act as a valuable fertiliser.

In the way of drainage material, the amateur who only grows a few plants might with advantage use the material for such purposes. Its cost would be but a mere trifle for each plant, with advantages obtained that would be incalculable.

Such plants as the variegated-leaved Begonias, Cinerarias, and Calceolarias would without doubt be highly benefited by such treatment, and when applied, both as a drainage material and part of the potting compost, water *ad libitum* might be used with impunity.

In connection with this subject we may direct attention to the use of sharp sand for potting purposes and for rooting cuttings in. We are not aware that there is any particular nutriment in the material for artificial cultivation; for potting purposes, its use appears to be solely to make the compost more close in its texture, so that air and evaporation may not play a too exhaustive part. Thus, in fibrous peaty soils, the material should be freely applied, and in stiff soils the contrary process should take place, they being already too compact and adhesive.

For rooting cuttings, with slight exceptions, no better material can be found, its chief uses consisting in retaining moisture, and by its compactness preventing the entrance of air to the base of the cuttings. The exceptions to the rule are applicable to very succulent plants, such as the Pelargonium, which prefers for rooting material a moderately stiff soil, or such a compost as will allow the free penetration of air through it.

It will thus be seen that sand may even be used with disadvantage, most people believing it indispensable to everything connected with the propagation and cultivation of plants.—*S. M.* in *Country Gentleman's Magazine.*

ARTESIAN WELLS IN CENTRAL AUSTRALIA.

SUCCESSFUL borings for water have been made in Frome County, South Australia, in a district hitherto almost devoid of surface water and regarded as consequently almost worthless for agricultural or pastoral purposes. One well, sunk in some arid country near Lake Frome at a distance of 400 miles north of Adelaide as the crow flies, on being bored to the depth of 370 feet, produces a daily supply of 10,000 gallons of excellent water; and other artesian wells in the same district have proved equally successful. As the result of the enterprise we are told that whereas that country would formerly only carry a few thousand head of stock, its capabilities are now partially unlimited. The success will stimulate similar enterprises elsewhere. Much of the so-called desert country, forming the boundry between the coast districts and the rich pastoral lands which have been discovered in the interior of the continent, will be reclaimed by this means. The South Australian Government is sending a scientific expedition to the shores of the Great Australian Bight, with a view to the selection of proper sites for artesian wells to tap the deep springs which are known to exist there; so that a part of the country which has hitherto been regarded as almost the most inhospitable portion of Australia will, by this means, be thrown open to agricultural enterprise.—*The Colonies.*

THE PITCHERI PLANT.

THIS curious plant has lately attracted some attention in Australia, on account of its powerful narcotic properties, which have long been known the aborigines of Queensland, though they are only just being brought under the notice of the medical profession. The plant, which is known by various names, such as pitcheri, pitchoury, bidgery, &c., is principally met with on the borders of Queensland and South Australia, between the 23rd and 24th parallels, growing in abundance on sandhills. It attains a height varying from eight to twelve inches. The leaf is very narrow, and between three and four inches in length, and the flower is bell-shaped, of a waxy white colour, streaked with red. The natives gather the leaves every year, during the month of August, when it is in blossom, drying them by a process of steaming, and then packing them in hemp bags for purposes of trade. To make it ready for use they damp it, mix ashes with it,

and roll it up into the shape of a cigar, which they [illegible] [illegible] behind the ear. The effect of the [illegible] of the novel cigar is very peculiar, rendering the smoker [illegible], almost insane, when indulged in too freely. When smoked in moderation, the leaves have a powerful stimulating effect; but the symptoms are somewhat similar to those produced by strong drink when taken to excess. The chewing of a small quantity of the leaves is said to assuage hunger, and a person so using them is enabled to undertake long journeys without fatigue and with little food. In this respect the plant resembles the celebrated *Coca erythroxylon* of South America. The plant is variously placed by botanists in the orders *Solanaceæ*, *Duboisia*, and *Scrophulariaceæ*. Its true botanical position and the exact nature of the medicinal properties possessed by it, are being investigated by Baron von Muller, Dr. Bancroft, and other distinguished botanists in Australia.—*The Colonies.*

FLY-CATCHING PLANTS.

MY attention has been directed to an interesting passage in which the carnivorous properties of the Drosera (sun-dew) are affirmed, though I believe the discovery that the plant not only catches, but *digests*, and is nourished by insects, is also, and mainly, due to the independent researches of Dr. Darwin. The passage occurs in a note on p. 13 of a small book entitled "Arran; a poem in six Cantos." By the Rev. David Landsborough, Minister of Stevenson, Ayrshire (Edinburgh, W. Blackwood, 1828). The author writes:

> "Should a fly
> Rashly presume to sip the sparkling dew,
> Or leaflet fresh to crop, she dies the death.
> The viscous dew soon clogs her wings and feet;
> And soon her mouldering form strengthens the plant,
> Which,thus, when persecuted, better thrives."

To this the following note is appended:—"What I have said respecting the sun-dew being nourished by the dead bodies of the flies which it entangles, *is a theory of my own*, in so far as it relates to the sun-dew, but I have little doubt that it is a correct one." He adds that Sir J. E. Smith was aware that the American plant *Dionæa muscipula* is "to a certain extent nourished by the insects which it catches." The "viscous dew" of the Drosera is simply vegetable pepsine. The author made one curious mistake respecting it, that he supposed its purpose was "to prevent small insects from infesting the leaves." It is more likely that they are attracted by it, as the aphis is by the "honey dew" on the leaves of the lime-tree. One of the best examples of a fly-trap is fournished by *Arum maculatum*. If the spathe is cut open, the ball at the lower part will generally be found full of flies. They creep in, attracted by the strong scent of the spadix, and are prevented from returning by the fringe of deflexed hairs which fill the constricted part or neck of the spathe.—*F. A. Paley.*

PASTORAL BEES.

(*Continued from No. 9, page 310.*)

TOWARD the close of the season, say in July or August, the *fiat* goes forth that the drones must die; there is no further use for them. Then the poor creatures, how they are huddled and hustled about, trying to hide in corners and by-ways! There is no loud, defiant humming now, but abject fear seizes them. They cower like hunted criminals. I have seen a dozen or more of them wedge themselves into a small space between the glass and the comb, where the bees could not get hold of them, or where they seemed to be overlooked in the general slaughter. They will also crawl outside and hide under the edges of the hive. But sooner or later they are all killed out. The drone makes no resistance, except to pull back and try to get away; but (putting yourself in his place) with one bee a-hold of your collar or the hair of your head, and another a-hold of each arm or leg, and still another feeling for your waist-bands with his sting, the odds are greatly against you.

It is a singular fact, also, that the queen is made, not born. If the entire population of Spain or Great Britain were the offspring of one mother, it might be found necessary to hit upon some device by which a royal baby could be manufactured out of an ordinary one, or else give up the fashion of royalty. All the bees in the hive have a common parentage, and the queen and the worker are the same in the egg and in the chick; the patent of royalty is in the cell and in the food; the cell being much larger, and the food a peculiar stimulating kind of jelly. In certain contingencies, such as the loss of the queen with no eggs in the royal cells, the workers take the larva of an ordinary bee, enlarge the cell taking in the two adjoining ones, and nurse it and stuff it and coddle it, till at the end of eighteen days from the egg it comes out a queen. But ordinarily, in the natural course of events, the young queen is kept a prisoner in her cell till the old queen has left with the swarm; and not only kept, but guarded against the mother queen, who only wants an opportunity to murder every royal scion in the hive. The queens, the one a prisoner and the other at large, pipe defiance at each other at this time—a shrill, fine, trumpet-like note that every ear will at once recognize. This challenge, not being allowed to be accepted by either party, is followed, in a day or two, by the abdication of the old queen; she leads out the swarm, and her successor is liberated by her keepers, who, in her time, abdicates in favor of the next younger. When the bees have decided that no more swarms can issue, the reigning queen is allowed to use her stiletto upon her unhatched sisters. Cases have been known where two queens issued at the same time, when a mortal combat ensued, encouraged by the workers, who formed a ring about them, but showed no preference, and recognised the victor as the lawful sovereign. For these and many other well-known facts we are indebted to the elder Huber.

It is worthy of note that the position of the queen-cells is almost always vertical, while that of the drones and workers is horizontal; majesty stands on its head,—which fact may be a part of the secret.

The notion has always very generally prevailed that the queen of the bees is an absolute ruler and issues her royal orders to willing subjects. Hence Napoleon the First sprinkled the symbolic bees over the imperial mantle that bore the arms of his dynasty; and in the country of the Pharaohs the bee was used as the emblem of people sweetly submissive to the orders of its king. But the fact is, a swarm of bees is an absolute democracy, and kings and despots can find no warrant in their example. The powers and authority are entirely vested in the great mass—the workers. They furnish all the brains and foresight of the colony, and administer its affairs. Their word is law, and both king and queen must obey. They regulate the swarming, and give the signal for the swarm to issue from the hive; they select and make ready the tree in the woods and conduct the queen to it.

The peculiar office and sacredness of the queen consists in the fact that she is the mother of the swarm, and the bees love and cherish her as a mother and not as a sovereign. She is the sole female bee in the hive, and the swarm clings to her because she is their life. Deprived of their queen and of all brood from which to rear one, the swarm loses all heart and soon dies, though there be an abundance of honey in the hive.

The common bees will never use their sting upon the queen; if she is to be disposed of they starve her to death; and the queen herself will sting nothing but royalty—nothing but a rival queen.

The queen, I say, is the mother bee; it is undoubtedly complimenting her to call her a queen and invest her with regal authority, yet she is a superb creature, and looks every inch a queen. It is an event to distinguish her, amid the mass of bees when the swarm alights; it awakens a thrill. Before you have seen a queen you wonder if this or that bee, which seems a little larger than its fellows, is not she, but when you once really set eyes upon her you do not doubt for a moment; you know *that* is the queen. That long, elegant, shining, feminine-looking creature can be none less than royalty. How beautifully her body tapers, how distinguished she looks, how deliberate her movements! The bees do not fall down before her, but caress her and touch her person. The drones, or males, are large bees too, but coarse, blunt, broad-shouldered, masculine looking. There is but one fact or incident in the life of a queen that looks imperial and authoritative: Huber relates that when the old queen is restrained in her movements by the workers, and prevented from destroying the young queen in their cells, she assumes a peculiar attitude and utters a note that strikes every bee motionless, and makes every head bow; while this sound lasts not a bee stirs, but all look abashed and humbled, yet whether the emotion is one of fear, or reverence, or of sympathy with the distress. The moment it ceases, and she advances again towards the royal cells, the bees bite and pull and insult her as before.

I always feel that I have missed some good fortune if I am away from home when my bees swarm. What a delightful summer sound it is! How they come pouring out of the hive, twenty or thirty thousand bees, each striving to get out first! It is as when the dam gives way and lets the waters loose; it is a flood of bees which breaks upward into the air and becomes a mass of whirling black lines to the eye and a soft chorus of myriad musical sounds to the ear. This way and that way they drift, now contracting, now expanding, rising, sinking, growing thick about some branch or bush, then dispersing and massing at some other point, till finally they begin to alight in earnest, when in a few moments the whole swarm is collected upon the branch, forming a bunch perhaps as a two-gallon measure. Here they will hang from one to three or four hours, or until a suitable tree in the woods is looked up, when, if they have not been offered a hive in the mean time, they are up and off. In hiving them, if any accident happens to the queen the enterprise miscarries at once. One day I shook a swarm from a small pear-tree into a tin pan, set the pan down on a shawl spread beneath the tree, and put the hive over it. The bees presently all crawled up into it, and everything seemed to go well for ten or fifteen minutes, when I observed that something was wrong; the bees began to buzz excitedly and to rush about in a bewildered manner; then they took to the wing and all returned to the parent stock. On lifting up the pan, I found beneath it the queen with three or four other bees. She had been one of the first to fall, had missed the pan in her descent, and I had set it upon her. I conveyed her tenderly back to the hive, but either the accident terminated fatally with her or else the young queen had been liberated in the interval, and one of them had fallen in combat, for it was ten days before the swarm issued a second time.

No one, to my knowledge, has ever seen the bees house-hunting in the woods. Yet there can be no doubt that they look up new quarters either before or on the day the swarm issues. For all bees are wild bees and

incapable of domestication; that is, the instinct to go back to Nature and take up again their wild abodes in the trees is never eradicated. Years upon years of life in the apiary seems to have no appreciable effect toward their final, permanent domestication. That every new swarm contemplates migrating to the woods seems confirmed by the fact they will only come out when the weather is favorable to such an enterprise, and that a passing cloud, or a sudden wind after the bees are in the air, will usually drive them back into the parent hive. Or an attack upon them with sand or gravel, or loose earth or water, will quickly cause them to change their plans. I would not even say but that, when the bees are going off, the apparently absurd practice, now entirely discredited by regular bee-keepers but still resorted to by unscientific folk, of beating upon tin pans, blowing horns, and creating an uproar generally might not be without good results. Certainly not by drowning the "orders" of the queen but by impressing the bees as with some unusual commotion in Nature. Bees are easily alarmed and disconcerted, and I have known runaway swarms to be brought down by a farmer ploughing in the field who showered them with handfuls of loose soil.

When a swarm leaves for the woods they are off before you fairly know it. They drift away from the hive in a wide-spread and apparently aimless concourse, then suddenly gather up their skirts, draw together their forces, and away they go, a humming, flying vortex of bees, the queen apparently in the centre and the mass revolving about her as a pivot, over orchards and meadows, across creeks and swamps, or woods and deep valleys, straight for the appointed tree, slow at first, so that you can keep up with them, but presently with a speed that would tire a fox-hound. In this flight the individual bees do not move in right lines, or straight forward like a flock of birds, but round and round like chaff in a whirlwind; unitedly they form a whirling, revolving, nebulous mass fifteen or twenty feet across, that goes as straight as a projectile to its mark. They are not partial as to the kind of tree,—pine, hemlock, elm, birch, maple, hickory,—any tree with a good cavity high up or low down. A swarm of mine ran away from the new patent hive I gave them, and took up their quarters in the hollow trunk of an old apple-tree across an adjoining field. The entrance was a mousehole near the ground. Another swarm in the neighbourhood deserted their keeper and went into the cornice of an out-house that stood amid evergreens in the rear of a large mansion. But there is no accounting for the taste of bees, as Samson found when he discovered the swarm in the carcass, or more probably, the skeleton of the lion he had slain.

In the woods of all parts of the country that have been settled any length of time, these wild swarms are more or less abundant, and furnish the occasion for one of the most delightful pastimes the autumn brings, namely, bee-hunting. Nearly every neighbourhood in the back country has its noted bee-hunter, usually one of those picturesque characters that savour so strongly of the wild, and with an eye that will follow a bee nearly as far as ordinary vision will follow the flight of a bird.

One night on the Potomac a party of us unwittingly made our camp near the foot of a bee-tree which next day the winds of heaven blew down, for our special delectation,—at least so we read the sign. Another time, while sitting by a water-fall in the leafless April woods, I discovered a swarm in the top of a large hickory. I had the season before remarked the tree as a likely place for bees, but the screen of leaves concealed them from me. This time my former presentiment occurred to me, and, looking sharply, sure enough there were the bees, going out and in a large irregular opening. In June a violent tempest of wind and rain demolished the tree, and the honey was all lost in the creek into which it fell. I happened to go along that way two or three days after the tornado, when I saw a remnant of the swarm; those, doubtless, that escaped the flood and those that were away when the disaster came, hanging in a small black mass to a branch high up near where their home used to be. They looked forlorn enough. If the queen was saved, the remnant probably sought another tree; otherwise the bees must have soon died.

I have seen bees desert their hive in the spring when it was infested with worms or when the honey was exhausted; at such times the swarm seems to wander aimlessly, alighting here and there, and perhaps in the end uniting with some other colony. In case of such union, it would be curious to know if negotiations were first opened between the parties, and if the houseless bees are admitted at once to all the rights and franchises of their benefactors. It would be very like the bees to have some preliminary plan and understanding about the matter on both sides.

Bees will accommodate themselves to almost any quarters, yet no hive seems to please them so well as a section of a hollow tree—"gums" as they are called in the south and west where the sweet gum grows. In some European countries the hive is always made from the trunk of a tree, a suitable cavity being formed by boring. The old-fashioned straw hive is picturesque, and a great favorite with the bees.

There is an old superstition still cherished in some parts of the country, that in order to have luck with bees, you must tell them of any death that occurs in the family. If you fail to do this they will go off or will perish in the hive. In the edge of the evening, after the bees are all in from the day's toil, if it be summer, the master or owner approaches the hive, raps gently upon it, and when the bees respond with their inquiring buzz, says softly, "John [or May] is dead." It is a round-about recognition of the fact that unless you take a lively interest in your bees, and become intimate with them and they with you, and have a good understanding on both sides, they will not prosper under your care.

The life of a swarm of bees is like an active and hazardous campaign of an army; the ranks are being continually depleted, and continually recruited. What adventures they have by flood and field, and what hair-breadth escapes! A strong swarm during the honey season loses, on an average, about four or five thousand per month, or one hundred and fifty per day. They are overwhelmed by wind and rain, caught by spiders, benumbed by cold, crushed by cattle, drowned in rivers and ponds, and in many nameless ways cut off or disabled. In the spring the principal mortality is from the cold. As the sun declines they get chilled before they can reach home. Many fall down outside the hive, unable to get in with their burden. One may see them coming home utterly spent and dropping hopelessly into the grass in front of their very doors; before they can rest, the cold has stiffened them. I go out in April and May and pick them up by the handfuls, their baskets loaded with pollen, and warm them in the sun or in the house, or by the simple warmth of my hand, until they can crawl into the hive. Heat is their life, and an apparently lifeless bee may be revived by warming him. I have also picked up drowning bees while rowing on the river, and seen them safely to shore. It is amusing to see them come hurrying home when there is a thunder-storm approaching. They come piling in till the rain is upon them. Those that are overtaken by the storm doubtless weather it as best they can in the sheltering trees or grass. It is not probable that a bee ever gets lost by wandering into strange and unknown parts. With their myriad eyes they see everything; and then, their sense of locality is very acute—is, indeed, one of their ruling traits. When a bee marks the place of his hive, or of a bit of good pasturage in the fields or swamps, or of the bee-hunter's box of honey on the hills or in the woods, he returns to it as unerringly as fate.

Honey was a much more important article of food with the ancients than it is with us. As they appear to have been unacquainted with sugar, honey, no doubt, stood them instead. It is too rank and pungent for the modern taste; it soon cloys upon the palate. It demands the appetite of youth, and the strong robust digestion of people who live much in the open air. It is a more wholesome food than sugar, and modern confectionery is poison beside it. Beside grape sugar, honey contains manna, mucilage, pollen, acid, and other vegetable odoriferous substances and juices. It is a sugar with a kind of wild natural bread added. The manna of itself is both food and medicine, and the pungent vegetable extracts have rare virtues. Honey promotes the excretions and dissolves the glutinous and starchy impediment of the system.

Hence it is not without reason that with the ancients, a land flowing with milk and honey, should mean a land abounding in all good things; and the queen in the nursery rhyme, who lingered in the kitchen to eat "bread and honey" while the "king was in the parlour counting out his money," was doing a very sensible thing. Epaminondas is said rarely to have eaten anything but bread and honey. The Emperor Augustus one day inquired of a centenarian how he had kept his vigor of mind and body so long; to which the veteran replied that it was by "oil without and honey within." Cicero in his "Old age," classes honey with meat and milk and cheese as among staple articles of a well-kept farm-house.

Italy and Greece, in fact all the Mediterranean countries, appear to have been famous lands for honey. Mount Hymettus, Mount Hybla, and Mount Ida produced what may be called the classic honey of antiquity, an article doubtless in no wise superior to our best products. Leigh Hunt's "Jar of Honey" is mainly distilled from Sicilian history and literature, Theocritus furnishing the best yield. Sicily has always been rich in bees. Swinburne (the traveller of a hundred years ago) says the woods on this island abounded in wild honey, and that the people also had many hives near their houses. The idyls of Theocritus are native to the Island in this respect, and abound in bees—"flat-nosed bees" as he calls them in the Seventh Idyl—and comparisons in which comb-honey is the standard of the most delectable of this world's goods. His goatherds can think of no greater bliss than that the mouth be filled with honey-combs, or to be inclosed in a chest like Daphnis and fed on the combs of bees; and among the delectables with which Arsinoë cherishes Adonis are "honey-cakes," and other titbits made of "sweet honey." In the country of Theocritus this custom is said still to prevail: when a couple are married the attendants place honey in their mouths, by which they would symbolize the hope that their love may be as sweet to their souls as honey to the palate. It was fabled that Homer was suckled by a priestess whose breasts distilled honey, and that once when Pindar lay asleep the bees dropped honey upon his lips. In the Old Testament the food of the promised Immanuel was to be butter and honey (there is much doubt about the butter in the original), that he might know good from evil; and Jonathan's eyes were enlightened by partaking of some wood or wild honey; "See, I pray you how mine eyes have been enlightened, because I tasted a little of this honey." So far as this part of his diet was concerned therefore, John the Baptist, during his sojourn in the wilderness, his divinity-school-days in the mountains and plains of Judea, fared extremely well. About the other part, the locusts, or, not to put too fine a point on it, the grasshoppers, as much cannot be said, though they were among the creeping and leaping things the children of Israel were permitted to eat. They were probably not eaten raw but roasted in that most primitive of ovens, a hole in the ground made hot by building a fire in it. The locusts and honey may have been served together, as the Bedas of Ceylon are said to season their meat with honey. At any rate, as the locust is often a great plague in Palestine, the prophet in eating them found his account in the general weal and in

the [illegible] of the [illegible] bees; the fewer [illegible], more [illegible]. Owing to its [illegible] wild [illegible] and flowering shrubs, Palestine has always been a famous country for bees. They deposit their honey in hollow trees as our bees do when they escape from the hive, and in holes in the rocks as ours do not. In a tropical or semi-tropical climate bees are quite apt to take refuge in the rocks, but where ice and snow prevail, as with us, they are much safer high up in the trunk of a forest tree.

The best honey is the product of the milder parts of the temperate zone. There are too many rank and poisonous plants in the tropics. Honey from certain districts of Turkey produces headache and vomiting, and that from Brazil is used chiefly as medicine. The honey of Mount Hymettus owes its fine quality to wild thyme. The best honey in Persia and in Florida is collected from the orange blossom. The celebrated honey of Narbonne in the south of France is obtained from a species of rosemary. In Scotland good honey is made from the blossoming heather.

California honey is white and delicate and highly perfumed, and now takes the lead in the market. But honey is honey the world over; and the bee is the bee still. "Men may degenerate," says an old traveller, "may forget the arts by which they acquired renown; manufactures may fail, and commodities be debased, but the sweets of the wild flowers of the wilderness, the industry and natural mechanics of the bee, will continue without change or derogation"—*Scribner's Magazine*.

DESTRUCTION OF FORESTS.

A WRITER in the *American Iron Age* who has been making a study of forest trees, their rapid destruction in that country, and their effect on climate and health, says that since 1835 the forest area of the Western Hemisphere has decreased at the yearly average rate of 7,600,000 acres, or about 11,000 square miles, and that this rate in the United States alone has advanced from 1,600 square miles in 1835 to 7,000 in 1855, and 8,400 in 1876, while the last two years have scarcely been less exhaustive. Statistics for 80 years previous to 1835 show that we have been wasting the supply of moisture to American soil at the average rate of seven per cent. for each quarter of a century during the last 125 years, and that we are now approaching the limit beyond which any further decrease will materially influence the climate of the entire continent. Many Eastern regions—such as Afghanistan, Persia, India, and Asia Minor—once possessed of a fine climate and abundant harvest, are now often scourged by pestilence and famine, and it is altogether probable that their misfortunes began with the disappearance of their native forests. It is quite likely that we shall suffer in climate, fertility, and health before a great while if we continue to destroy our trees as recklessly as we have done, and it behoves us to be warned in time. What has happened elsewhere, may certainly happen here. Indeed, there is great danger of it, for we know by experience that fertile lands have grown sterile by loss of trees, and that sterile lands have in turn become fertile by systematic planting. A certain proportion of well wooded as well as arable pasture land is essential to our material prosperity, and this proportion can never be kept up unless regular tree planting be adopted as a set-off to the excessive destruction incessantly going on. For 150 years we have been felling the forest; for the next 150 we should try to restore what we have taken away.

COMPARATIVE VALUE OF OAK BARK.

THE question has often been propounded whether the bark of the *Quercus peduculata* or of the *Quercus robur* is the more valuable in tanning operations. The reply must materially depend on the proportion of tannin and other astringent principles which they respectively contain, the quality of these substances being the exact measure of their value for the purpose named. Some researches on this point have recently been undertaken by M. W. Eitner, the results of which are of considerable interest. He analysed the bark of each variety, taken from twelve-year old trees, grown on the same site under precisely similar conditions, and in the course of his operations not only determined the point at issue, but also established the fact that the percentage of tannin in the bark of each variety varies considerably according to the time of the year at which it is stripped. Of barks stripped at the end of April, that of *Q. pedunculata* contained 14·80 per cent. of tannin, and that of *Q. robur* 12·86 per cent. At the end of May the respective proportions were 10·71 and 10·46 per cent.; at the end of June, 12·33 and 10·58 per cent.; at the end of July, 9·80 and 8·11 per cent.; and at the end of August, 11·23 and 10·74 per cent. of tannin. From this it appears that the *Quercus pedunculata* variety proved the more valuable throughout, though the degree of its superiority over the other varied exceedingly according to the time at which the trees were barked. From other experiments in the same direction it appeared to be established that the first-named variety is more fitted for cultivation on woodland plains, while the *Quercus robur* succeeds but on the mountain side.

CATTLE MANURE EXPERIMENT.

WE have been favored with an interesting report on this subject of an experiment made at the Bangalore Experimental Farm, and print it *in extenso*.

Report on an experiment of the value of cattle manure during the half-year ending 31st December 1878.

The following experiment has been made for the purpose of bringing forward the difference in value of manure under the system of cattle-box manufacture adopted on this farm, and of the two common methods of treatment by the ryots in this province.

The cattle-box system of housing cattle is briefly as follows. Over a pit sunk about two-and-half feet in the ground, a shed is erected with eaves over-hanging in such a manner that neither the sun's rays can penetrate (except at an oblique angle in the morning and evening) to dry up the manure, nor the rainfall on or run into the pit to unduly wet the contents and render it too moist for the cattle to rest on. The cattle are housed in this shed at night, each in separate compartment, and were supplied, in the case of the present experiment, with grass only. In the morning a little litter, stalks of plants, leaves or unconsumed food, is strewn over the box, especially where the dung has been dropped, and nothing is removed until the pit is full, when the bulk of the manure is carted away to the field. The top layers not decomposed are replaced in the bottom of the empty pit as litter. In this way, twenty loads of manure per annum, containing the whole of the dung and urine dropped while the animal is not at work are secured; and bulk is obtained by utilising any waste substance for litter, thus adding a large amount of organic matter, which, placed in the soil, acts as a powerful retainer of moisture.

The cowdung employed in plot No. 2 was obtained from a grazing ground and placed in a heap for some months until required, the common native method of storing manure not required for fuel. The ashes were the result of burning an equal weight of the same cowdung representing the residuum from the "brelly," or cowdung cake, used for fuel throughout India.

The experiment was to test the comparative value of equal weights of each manures. Had the experiment taken the form of using the total amount of manure obtained from a bullock in the same time, the result would have been more striking.

It may be remarked that dung was from mature cattle fed only on grass, without any gram, oilcake, or other food to enrich the manure.

The crop on which the experiment was tried, was Queensland maize, grown on a poor light sandy loam. The seed was sown in rows 2 feet apart on the 18th April, and harvested for the sale of the green cobs, 18th of August.

The rainfall during the period of growth was 3·85 inches, but this was supplemented with occasional irrigation from a well as required.

The following are the results per acre :—

No. of Plot.	Manure per acre.	Green cobs lb.	Percentage of increase over unmanured plot.	Fodder lb.	Percentage of increase over unmanured plot.
Plot No. I.	Cattle-box manure 5½ tons.	5,870	+ 74	9,710	+ 71
" " II.	Dry cowdung 5½ tons. ...	4,480	+ 33	7,150	+ 26
" " III.	Ashes from 5½ tons cowdung	4,620	+ 37	4,480	— 20
" " IV.	Blank	3,360	...	5,650	...

The small quantity of manure employed, the minimum of water used, and the comparatively poor soil to which they were applied, fully account for the light yield, but the comparative result is very clear.

The yield of the cattle-box manure both in cobs and fodder of 74 per cent. and 71 per cent. respectively, over the unmanured plot, is remarkably high, the manure being well rotted and taken from the lowest part of the pit where it was thoroughly saturated with urine.

The slight increase of 4 per cent. given by the ashes over cattle dung manure is due to the forcing action of the former, the whole of the constituents being released from the organic combinations they were held as inassimilable vegetable matter. But as the dung of an animal has been proved by careful experiments in Europe to contain only about one-fourth of the plant food voided in both dung and urine, it is not surprising to find the result of its action far less energetic than when both are combined as in the case of the cattle-box manure. The actual decrease of fodder when ashes were employed is curious. The plant probably suffered under the too stimulating action of ashes from insufficient moisture, though the amount given when aided by the organic matter combined both in the dried cowdung and the cattle-box manure was adequate. The frequent waterings asserted as necessary for maize by native gardeners round Bangalore, are probably largely

due to their partiality for [illegible] as a manure, for on this farm where cattle-box manure is chiefly employed, and where a deeper cultivation is given, crops are raised with a considerably smaller amount.

F. E. HARMAN, M.R.A.C., F.C.S.,
Superintendent, Experimental Farm, Bangalore.

AGRICULTURE IN THE NIZAM'S DOMINIONS.*

THE condition of the agricultural population in his Highness the Nizam's territories has improved in a most remarkable degree since the accession to power of his Excellency Sir Salar Jung. Five-and-twenty years ago the peasantry of this portion of India were oppressed to an extent that is almost inconceivable in these days, where the social and economical condition of the ryot are matters which occupy the minds of the majority of Indian officials. The secret history of the tyranny exercised by former Mogul officials over the cultivating classes has yet to be written, and when it comes to light, we believe that it will prove to be a curious and not uninteresting chapter in the records of the Government of Native States. The Famine Commission, which visited the Nizam's capital last year, is not unlikely, we believe, to be the means of unearthing a good deal of information on this subject, which will afford food for reflection to those who profess to interest themselves in all matters pertaining to the amelioration of the unhappy condition of the majority of the Indian peasantry. The replies to the famine questions propounded by the gentlemen who visited Hyderabad will, we understand, contain an account of the manner in which agriculturists were robbed and tortured in this portion of the Deccan a quarter of a century ago. The officers who held high positions under the Nizam's Government in those days looked upon the ryot as a marketable commodity, to be sold to the highest bidder, who sold him and his belongings to somebody else, and so on till he came into the possession of some tender-minded fellow-countryman who plundered him of his crops and personal property, and tortured him when he could obtain neither. Such occurrences, however, are now happily past, and only serve to show the great improvement that has been made under the present *régime*. Sir Salar Jung, as soon as he accepted office, set vigorously to work to reform the agricultural abuses, which were a positive disgrace to the first Native State in India. He removed those officials who had made it the chief business of their lives to rob and oppress the peasantry, and in a very short time effected such a revolution as has occurred in few other Native States in India. At the present day the condition of the cultivators of the soil in the Nizam's territory will compare very favourably indeed with almost any of the Indian districts under British rule. They are not heavily taxed, the assessments in the majority of instances being altogether in the ryot's favour. They have never been compelled to contribute to an income-tax, a license-tax, or any other of the imposts with which the inventive genius of Indian officialdom delights to torture British Indian subjects. Mr. Furdoonji Jamshedji's admirable little work affords a complete insight into the condition and habits, both agricultural and domestic, of the peasantry in the chief district of the Nizam's dominions. Aurungabad, as most of our readers are probably aware, was once an exceedingly powerful Mahomedan province. The city which bears the same name was built by Aurangzebe at a period when Mogul influence was dominant in the Deccan, and it contains many interesting relics of the old Mogul empire. A new revenue survey was introduced lately in this district by the Nizam's Revenue Department, and the introduction of this new condition of things has afforded Mr. Furdoonji Jamshedji an opportunity of giving an interesting and valuable account of this portion of the Nizam's territory. It may be taken as a fair sample of the condition of the people in the other parts of the dominion. The work is divided into five chapters, giving an account of the four classes of agriculturists found in the district—Kunbi life and manners; agriculturists and labourers, and their working calendar for the year; and the agriculturist, the money-lender, and the civil courts. The Kunbi of the Nizam's dominions is, our author tells us, like "Charles the Second's Sailors," inasmuch as he makes his money like a horse, and spends it like an ass."

"His passions are not strong; he is apathetic, and takes things easily,—is never elated with success, nor is he readily prostrated by misfortune. He is a thorough Conservative. He will often suffer great wrongs with patience and resignation, but his indignation is aroused if the least encroachment be made upon his personal *watandari* rights, though they may yield him no profit, but happen, on the contrary, to be a tax upon his purse. If the regulated place be not assigned to his bullocks when they walk in procession at the *Pola* feast, or if he has been wrongfully preceded by another party in offering libations to the pile of fuel that is to be fired at the *Holi*, the Kunbi at once imagines that a cruel wrong has been done him, and his peace of mind is disturbed. He will haunt the courts of the taluk and district officials for redress, and, neglecting his fields, will pursue his object with a perseverance worthy of a better cause."

* *Notes on the Agriculturists of the District of Aurungabad, H. H. the Nizam's Dominions*; by Furdoonji Jamshedji, Superintendent, Revenue Survey and Assessment, North-Western Division (published at the *Times of India* Office.)

Some of the villages in this portion of the district still contain places of refuge which were used in the troublous days that preceded the present *rule*. The village fort is not a very pretentious structure, but it used generally to answer the purpose for which it had been erected,—namely, to protect its residents from the predatory hordes who made it their business to plunder all who came in their way. The houses of the cultivators are essentially built for use, not for ornament. As already stated, the ryots of the Aurungabad district are divided into four classes, and the following account of their domestic economy will not be found uninteresting :—

"The domestic economy of the household is regulated by the eldest woman of the family, who makes an excellent housewife. Butter is made from the fresh milk of the dairy, and is sent to the market for sale, while the whey and curds go to improve the family meals. With respect to the cultivators of the first and second classes, the careful housewife sees that a supply of grain, calculated to last for a full year, is stored in the house, while the vegetables are supplied from the Kunbi's own garden land. The first class of cultivators generally take three meals a day. Breakfast is served out about nine o'clock in the morning. It consists of hot jowari or bajri cakes, a dish of milk curds, and some chutney. Between twelve and one o'clock they take their midday meal, which generally consists of jowari or bajri cakes, some *dal*, and curry made with whey. The supper at night consists of bread and vegetables."

Amongst the village feasts the most noticeable is the *Pola*, held in honour of the village bullocks, who are bathed and have their horns painted and clad in the *sarees* of the owners' wives, and are led through the village and luxuriously feasted at the end of the *tamasha*. The book treats at some length of the manner in which the tenements are held, the system of cultivation, the methods of payment, the harvest, and the manner in which the village artisans are reimbursed by the Kunbi in grain for the services they have rendered him during the year. These include the blacksmith, carpenter, porter, barber, &c.; these people are all called *balutaydars*. The important question of the relationship between the ryot and the soucar is very fully gone into, and in a manner which shows that Mr. Jamshedji well understands what he is writing about. The ryots generally under the Nizam's rule are not indebted to the same extent as those in some parts of British territory; the Deccan, for instance. Mr. Hope, we think, might catch a few hints from what the author of the book has to say on this subject. The Hon'ble Member's Deccan Ryots' Bill will go far to place the British ryot on a level with his brother cultivators in the Nizam's dominions, inasmuch as it will remove not a few of the facilities that the soucars possess for gradually acquiring possession of the ryot, body and soul. But on so important a subject, we will allow our author to speak for himself. With the view to preventing the soucars from acquiring absolute and total possession of the ryot and his belongings, as is the case in many Deccan villages—

The following measures were adopted, and circular orders giving effect to them, were from time to time issued by the Judicial Department :—

1. No *ex-parte* decree was to be passed by a Civil Court against any debtor, until the creditor should have proved, by his books, or otherwise, to the satisfaction of the court, that the bond was executed for veritable and fair consideration.
2. If a usurious rate of interest had been charged, it was to be reduced to a reasonable rate. When the amount of interest did not exceed the amount of the principal, the rate of interest entered in the bond could be adhered to, but when the amount of interest did exceed the principal, the Hindu law of *Dám dupát* was to be enforced. Of however long standing the debt might be, the amount of interest given by decree was never to exceed the amount of principal.
3. When the cultivator was unable to pay at once the amount of the decree passed against him, the court could order it to be paid by reasonable instalments. If the circumstances of the case warranted, interest being allowed to run on the decree, one per cent. per annum only was to be allowed, until the debt was liquidated.
4. When attachment was issued against a cultivator's property, his house, his agricultural implements, his cattle, and a supply of grain enough to support him and his family till next harvest, was to be exempted from execution.
5. No judgment-debtor was to be imprisoned for debt unless suspected of having concealed his property to evade payment.

These measures have worked most satisfactorily. And it will be a happy day for the Poona ryot, when similar exceptions are made in his favor. On the whole, the book contains much that is both interesting and valuable, and is the more remarkable from having been written by a native, and in a manner and style that we have seldom seen surpassed. As a contribution to agricultural literature, it will be prized by those who interest themselves in such matters, and by the general reader as well.—*Statesman.*

BAMBOO PAPER.

WE see that in his report on the Royal Botanical Garden of Calcutta for the year 1878-79, Dr. King shows that he is still unconvinced as to the probable success of Mr. Routledge's scheme for making paper from bamboos, in fact the further experience gained during the year in the process of cropping clumps of *bamboos* in the way recommended by Mr. Routledge has confirmed Dr. King in the opinion previously formed of the unsuitability of the plan originally proposed by Mr. Routledge. Mr. Routledge, however, is understood to have changed his plan, and to have recommended that, instead of cutting down all the shoots

of a bamboo clump, only a few shoots should be annually taken from each clump. Dr. King says that this is the principle on which bamboos have been cut in India from time immemorial, and that no experiments on its feasibility are required. The value of the fibre contained in the succulent shoots of bamboo as a material for the manufacture of paper can only be tested by practical paper-makers. Even accepting Mr. Routledge's estimate of its value, the questions which, Dr. King says, should be settled are, whether commercial success can be obtained (1) by forming plantations of bamboos for the collection of succulent shoots; (2) by collecting the immature shoots of wild bamboos in the forests, and carrying them to a paper factory; or (3) by fitting up a floating paper-stock mill and moving it about on rivers by the banks of which bamboos naturally abound.—*Englishman.*

THE YAM TRIBE.

THIS family of plants is spread over all the intertropical region, and each continent possesses particular species; a small number grow in the temperate regions. These plants are as yet comparatively little known and badly described by botanists. Some grow wild in the forests, and many among them have a tuber which can be eaten with safety. The various yams cultivated are not simple races or varieties of one species, but species botanically distinct, presenting a foliage and aspect generally different, and tuberous roots varying in shape, size, and taste.

It is greatly to be desired in order to thoroughly understand and define all the species, that they could be collected and grown in some one of the Botanic Gardens in a warm climate, to appreciate the advantages of the best, and to furnish precise rules for the successful culture of each.

This important tribe of plants has tuberous roots, mostly edible, leaves with net-shaped veins, twining stems. The various kinds are distinguished by the shape and colour of the tubers. The West Indies is their favourite country; they are there what the potato is to Ireland; raw, they have an acrid principle. The tubers of various species are cultivated in nearly all tropical countries as important esculents. They abound in farinaceous matter, and often reach a large size. Their culture is considered to have spread from South-East Asia and the East Indian islands, where at present, *Dioscorea alata* is the most commonly grown.

The yam is universally cultivated among all the tribes of the islands of the Eastern Archipelago, and generally most so where rice is least abundant, but it nowhere forms the chief bread of the people, as rice, maize, or sago do. The Malay and Javanese name "ubi" or "uwe," extends not only to the languages of the Malay and Philippine Islands, but to those of the Pacific and Madagascar. With all the varieties of pronunciation there can be no doubt of the virtual identity of the name. It is probable that several species of *Dioscorea* are natives of the Malayan Archipelago, but that the culture originated with one people, and was directly or indirectly disseminated by them, seems likely from the universality of the same.

In the West Indies, the Indian, Barbados, and red yams are planted early in August and dug in the January following. The Portuguese and Guinea yams are planted early in January and dug in September. If not bruised, yams will keep well packed in ashes, the Indian yam nine months, the Barbados and red yams twelve months.

The roots grow very large, and are mealy and easy of digestion. Yams are generally both dry and palatable, and not inferior to any edible tubers in use, either in delicacy, flavour, or amount of nourishment. They are usually propagated by pieces, which must be cut so as to leave a little of the skin upon them, by which alone they germinate, for the roots have no apparent germs, but cast out their weakly stems from every part of the surface alike. They are put into convenient holes (two or three in each) which are generally dug pretty regular and about a foot-and-a-half or two feet square; these are afterwards filled in from the adjoining banks, and the whole piece covered with cane trash, which serves to keep the ground cool and fresh, and to prevent the growth of weeds, from which these plants must be carefully preserved until they grow sufficiently to cover the mould themselves. The roots should be lifted as carefully as possible, so as not to cut them, for those cut throw out their sprouts very early, and are seldom fit for anything but planting. (Browne's "History of Jamaica.")

There is an export of yams from some of the West India Islands; thus, in 1874, 1,926 cwt. of yams were shipped from Jamaica, valued at £573.

It is quite impossible to compare, as respects their qualities and agricultural advantages, the fifteen or twenty different species of *Dioscorea*, which are cultivated in various parts of the intertropical zone. We can only, therefore, furnish a few general indications gathered from different authors, and especially from the interesting work of M. Vieillard on the plants cultivated in New Caledonia.

According to the nature of the soil, careful culture, the vigour of the plants, and the distance at which they are set, the tubers will vary in size. It may be assumed that a fine average root will weigh 5 to 10lb., and that of a more feeble plant 2 to 3lb. The enormously large tubers sometimes recorded are generally those of the Negro or Guinea yam, which have remained several years in the ground, and these, according to some authors attain the weight of 30 to 40lb. Supposing that a field is planted exclusively with yams, at a distance of two yards apart, there might probably be anticipated a yield of 44,000 to 88,000lb. of roots.

The word yam is of American origin, and is met with in very old authors such as Vespucia and Hahrel, according to Alph. De Candolle in "Géographie Botanique." The Carib name is *niamé*, but in the English and Dutch colonies of America the word yam is generally used; in some of the old Spanish colonies of America they are called *ojes*; in Brazil, *caras*, in the Isle of Bourbon, *cambares*; in Malaysia, Tahiti, and New Caledonia, *ubi* or *oubi*.

From Baron Mueller's "Select Plants" suitable for Australia, Long's "Plants of Bengal," Drury's "Useful Plants of India," Dr. P. Sagot's "Agriculture de la Guyane Française," and other sources, we condense the following details as to the various species:—

Dioscorea aculeata (Linnæus). The Kaawi yam, Affoo, prickly or Guinea yam; India, Cochin China, South Sea Islands.

Stem prickly, as the name implies, not angular; leaves alternate, undivided, cordiform. It ripens later than some other species, and requires no poles for staking. It is propagated from small tubers. This yam is of a sweetish taste, and the late Dr. Seeman regarded it as one of the finest esculent roots of the globe. A variety of a bluish hue, cultivated in Central America (for instance at Caracas), is of a very delicious taste.

In Bombay this species is called the Gea potato; the root weighs about two pounds. It recommends itself by the excellent quality of its produce and its easy multiplication.

Dioscorea alata (Linn.). The winged stalked, Negro or red yam, Uvi-yam; India and South Sea Islands. The stems are four-angled and not prickly. The tubers, of which there are many varieties, will attain, under favourable circumstances, a length of eight feet, and the prodigious weight of one hundred pounds! They are, for the most part, ovoid, more or less long. This species, and the preceding one, are the two principal kinds cultivated in tropical countries. *D. alata* is, in culture, supported by reeds. It is propagated from pieces of the old root, and comes in warm climes to perfection in about seven months. The tubers may be baked or boiled. It is this species which has been successfully cultivated in New Zealand, and also in the Southern States of North America. This is the principal food plant of the New Caledonians, and the tubers there weigh as much as 17lb.

Dioscorea bulbifera (Linn.) The natives of Tahiti, India, and New Holland, in times of scarcity, eat the axillary bulbs of this yam which are about the size of a small potato, and they are also eaten, according to Dr. Sagot, in French Guiana, where the plant grows wild in the woods. It is sometimes called the Granada yam.

Dioscorea cayennensis (Kunth.), *D. altissima* (Lamk.), *D. Berteroana*; Negro or Guinea yam; tropical South America, originally introduced from Africa. The stem is spiny, the leaves entire, cordiform; the tubers generally simple, flat, more or less ovoid, large, but tender and less delicate in flavour than the Indian yam. It is, however, very productive, and less exigent of good soil.

Dioscorea fasciculata (Roxburgh). India. This species has several stems. The natives of India extract starch from the tubers which are long, and collected in bundles. Several species of India and the Archipelago, such as *D. divaricata* (Blanco), *D. oppositifolia* (Linn.), &c., grow luxuriantly.

Dioscorea globosa (Roxburgh). India. This is the favourite yam among the natives of Bengal. The stems have six wings with the angles, and the tubers are large and round.

Dioscorea Hastifolia (Nees). Extra tropical Western Australia. Evidently one of the hardiest of the yams, and on that account deserves particularly to be drawn into culture. The tubers are largely consumed by the aborigines for food; it is the only plant on which they bestow any kind of cultivation, crude as it is.

Dioscorea Japonica (Thunberg), *D. Batatas* (Decaisne). The hardy Chinese and Japan yam. The attempt to cultivate this species generally in Europe, attracted considerable attention some eight or ten years ago, but it has not made progress. Baron Mueller remarks: This species, which is not prickly, has been cultivated some years in the Melbourne Botanic Garden. The material here for comparison is not complete, but seems to indicate that *D. transversa* (R. Br.), and *D. punctata* (R. Br.), are both referable to *D. Japonica*. If this assumption should prove correct, then we have the yam along the coast tracts of North and East Australia, as far south as latitude 33°. In Australia we find the wild root of good taste.

Dioscorea nummularia (Lamk). The Tivolia yam. Continental and Insular India, also South Sea Islands. A high climbing prickly species with opposite leaves. Roots cylindrical, as thick as an arm; their taste exceedingly good.

Dioscorea oppositifolia (Linn.) India and China. Not prickly. One of the edible yams.

Dioscorea pentaphylla (Linn.) The kidney rooted yam. Continental and Insular India, also South Sea Islands. Likewise a good yam. A prickly species with alternate divided leaves with four or five lobes. Not cultivated in Bengal, but very much so in Amboyna.

Dioscorea purpurea (Roxburgh). India. In Bengal considered the next best to *D. alata*.

Dioscorea quinqueloba (Thunberg). Japan, and there one of several yam plants with edible tubers.

Among numerous congeners are mentioned as providing likewise root, vegetables—

D. piperifolia (Humboldt), from Quito; *D. esurientum*, (Fenzl.), from Guatemala; *D. tuberosa* and *D. conferta*, (Arrab.), from South Brazil, and

D. deltoidea (Willd.), from Nepal. Of these and many other species, the relative quality of the roots and the degree of facility, of their field culture require to be more ascertained.

Dioscorea sativa (Linn.) The common yam. South Asia, east as far as Japan, also in the South Sea Islands and North and tropical East Australia likewise recorded from tropical Africa. Stem cylindrical, not prickly The acrid root requires soaking before boiling. It has proved hardy in the Southern States of North America.

Dioscorea spicata (Roth.) India. Root used like those of other species.

Dioscorea tomentosa (Koenig). Ooyata yam. India. The nomenclature of some of the Asiatic species requires further revision.

Dioscorea trifida (Linn. fil.), Central America. One of the yams there cultivated.

Dioscorea triphylla (Linn.). The buck yam. Tropical Asia. As an edible root equal to the potato, if not superior to it. Some varieties of this yam are purple fleshed, often of a very deep tint, approaching to black.

Dioscorea triloba (Lam.).; *D. affinis* (Kth.).; *D. truncata* (Miquel) *D. trifida* (Meyer). The Indian yam. This species has been in cultivation from time immemorial by the aborigines of America. Its tubers are most agreeable to the taste. The stem is without spines, the leaves are large, the lower ones have five to seven lobes, the upper ones three. The tubers are numerous, ovoid or round, covered with a blackish skin, rather cracked. This excellent species is much cultivated in Brazil, Guiana, and the West Indies.

Various other tuberous *Dioscoreæ* occur in tropical countries; but their respective degree of hardiness, taste, and yield are not recorded or ascertained.

THE CORK TREE.

Of all the various productions of the vegetable kingdom which man appropriates to his own use and convenience, there is hardly one so universal as the bark from the cork tree, for not only is it employed in the arts and manufactures, but articles for domestic purposes, such as stoppers to bottles, &c., are to be found in all parts of civilised countries. The trees from which this substances is obtained are a species of oak, *Quercus Suber*, and its variety *Q. occidentalis*, the first of which grows plentifully in the south of France, Spain, Algeria, and in some parts of Italy, the second is a native of the Atlantic side of France and Portugal, where this tree grows to the greatest perfection, and to which country we are indebted for the major part of our supply.

The cork tree bears a general resemblance to the broad-leaved kind of *Q. ilex*, or evergreen oak, of which species some authors consider it only a variety, but when full grown it forms a much handsomer tree. The wood of the cork tree is of little value for constructive purposes, as it is liable to decay, and it also is said to contain an acid which destroys nails driven into it, but it makes an excellent fuel in the countries where it is grown. The value of the bark fully compensates for the inferiority of the wood. When the tree has arrived at a certain state of maturity, or twenty years—some say earlier—it periodically throws off its bark after it has grown a prodigious thickness and begins to clothe itself with a new one. The bark thus cast off is very indifferent and of little commercial value; to prevent this the tree is not allowed to have its own way, but the bark is artificially removed by the following process:—

In the months of July and August, when the sap flows plentifully, a circular incision is first made, a few inches above the surface of the ground, then a similar circular cut round the trunk immediately under the main branches, care being taken not to penetrate the inner bark. The portion intervening between the two cuts is then slit down longitudinally in three or four places, which divides the bark into broad sheets or planks. The tree is now left for a time so that the moisture from the sap may dry. The bark is then removed from the stem, more or less curved according to the breadth and diameter of the trees from which it has been taken. The instrument used for cutting and removing the bark from the stem is a sort of axe, the handle of which is flattened into a wedge-like shape at the extremity, which serves to raise the bark. This axe is not unlike that used in Britain for taking off the bark from the common oak. The bark grows again, and as this tree exists, according to Dr. Hamel, a hundred and fifty years or more, its disbarking takes place regularly every eight, nine, or ten years, the quality of the bark improving with the increasing age of the tree, which is not in the slightest degree injured by the process. At the first and second gathering the bark is only fit for floats for fishermen's nets and other inferior uses, it is not until the third disbarking that the substance has attained the desired perfection for the manufacture of corks. The sheets, layers, or tables of cork as they are called, are now scraped on the outer surface to remove the coarser parts of the epidermis and any epiphytes or other extraneous substance. They are then thrown into deep pits, and covered with water to soften them in order to be flattened by pressure under heavy stones, after which they are dried over a fire, being frequently turned during the process to prevent their returning to their original shape.

There is also another method by which the moist pressure in pits is dispensed with and the bark is drawn flat by the sheets having their convex side placed towards the fire. In time they are considerably charred by the heat; they are then turned and charred on the other side, though in a less degree. This charring gives the material what the cork-cutters call nerve, and has also the effect of closing the pores of the cork which otherwise would absorb moisture and render it useless for the purpose of stoppers, bungs, &c. Too much burning destroys its elasticity, but if not sufficiently burnt, it will not be firm enough for the operations of the cork-cutter's knife. The bark now undergoes a rough cleansing; it is then built up into large stacks until it is bought for exportation by the cork merchants and dealers.

The bark of many trees resembles cork. There is a variety of *Ulmus campestris suberosa*, the cork-bark elm, which grows in our hedgerows, whose bark assumes something of the external appearance of cork in its softness and elasticity, as well as in its chemical properties; but as it does not grow to any great thickness, it is not of any value for economic purposes.

The cork tree, *Q. Suber*, and its varieties, are to be found growing in many of the botanical, horticultural, and private gardens of England. It was introduced in or before 1699 by the Duchess of Beaufort, and is readily propagated by acorns.

Where the bark of *Quercus Suber* cannot be obtained, many substitutes have been found to supply its place among the spongy bark or wood substances of other trees. The wood of *Anona palustris*, growing in the West Indies, called the alligator apple, is of such a soft nature that it is frequently used by the negroes, instead of corks to stop their jugs and calabashes.

The word cork is said to be derived from the Spanish *corcho*, from the Latin *cortex*.—*H. G. Glasspoole, in the Pharmaceutical Journal.*

WILFUL WATER WASTE IN THE MADRAS PRESIDENCY.

One of the chief points urged in recent publications from the Madras Agricultural Department has been the great and reckless waste of water which characterises irrigation in this presidency. Mr. Robertson has raised his voice in this behalf again and again, only to be told, "The Board of Revenue does not agree with Mr. Robertson." "The Board," in its wisdom, refusing to give reasons why, and scarcely ever attempting to upset the Agricultural Director's conclusions by argument or illustration, which indeed are too soundly based to be overthrown. Mr. Robertson is not alone in his opinions on this point. They are shared by his chief colleague, the gentleman who has now temporary charge of the department. Under these circumstances, and remembering that the rising intellect in the country, both in the services and out of them, so far as it has grasped the problem, is with the experienced agriculturists named, we may be hopeful of a change taking place at no distant interval. The time indeed is coming when men will ask whether it really can be true that such reckless waste, such wilful waste causing woful want, was tolerated for any length of time by a Government professing to be guided by scientific knowledge.

The enormous amount of water used in growing paddy is held to be most unjustifiable. On the Cauvery valley lands it is said to be customary to maintain constantly in the paddy field, until close on the time for harvest, from two to six inches of water, making good by daily additions the losses by infiltration and evaporation, which are said to amount to at least one inch in depth daily. The quantity used probably is not less than a volume from ten to fifteen feet in depth,—let the reader pause and imagine the mass of liquid thus typified—an amount which, it is said by competent authority, would suffice for the cultivation of three times the area of paddy now watered in this manner. It is no wonder when such is the mode of culture adopted, that the yield of staple crops in this presidency should be so miserable as it is. While in Great Britain the average yield of wheat per acre is 1,800lb., and of pulses 1,700lb. in Madras, the respective proportions are (cereals) 700lb. and (pulses) 450lb. To further show how wretchedly backward we are in this respect as compared with other countries, we may give the average yield per acre of three other countries, *viz*:—

	Wheat	Pulses
	lb.	lb.
Belgium	1,650	1,470
Holland	1,500	1,680
France	1,030	8,010

The smaller yield in this presidency is due not to unfavourable circumstances climatically, or inherently poor soil, but to vicious modes of cultivation, of which it would be well if the ryot could be thoroughly purged.

One chief reason why the cultivator wastes so much water is obviously because he does not pay for what he receives according to the quantity he uses. In Orissa, we believe, and certainly in Northern India, compulsory water rates have not been found to work very favourably or to conduce to harmonious relations between cultivators and irrigation authorities. This was, to a great extent, due to causes altogether apart from the evil we complain of with regard to the great irrigation works in the south of this presidency. It is absolutely certain that if the ryots were permitted to use, free of charge, only one-third of the water they now soak their fields with, and were made to pay for all over that quantity, they would be much more chary of misuse, and would more carefully guard against abuse than they do now, It should not be too difficult for the revenue and irrigation officers to devise means whereby such a result might de achieved. If the present waste were checked, the consequence could not fail to be good for the ryot himself. He would, for one thing, be compelled to practice a bett r system of agriculture,—in itself an enormous gain, the consequences of which can hardly be over-rated. Further, and also great gain, the advantages of irrigation could be largely extended, and areas now unproductive for want of water would be made to yield to the nation's needs in the matter of food supplies. Again, and still more important, the present product of such wasteful culture as we have described is a most inferior grain. The paddy

grain is an extremely low feeder, very far inferior to raggi and maize, neither of which require one-seventh of the water demanded by paddy. Under present unsatisfactory circumstances, attention is almost entirely confined to paddy growth, which year after year, generation after generation, with occasional fallow years, is grown from the same area. Under such circumstances as we advocate, the ryot would be driven to adopt rotation of crops, a greater variety of food stuffs would be provided, and the gain to the individual and to the country would be immense.

Upon such an apparently small change as that involved in regulating the wilful waste of water on paddy fields, the prosperity of one portion of a great Empire depends, and is allowed to be frittered away, apparently with utter heedlessness, for outside the Department of Agriculture in this presidency we know of no body who has concerned himself with this matter. The Agricultural Department is yet in its infancy; one day it is destined to be the most important in the Empire, but at present its power for good; its influence against evil, are only small. We make bold to say that in all its officers have attempted, the department has deserved well of the public, but in nothing is it so deserving of hearty support as in the matter to which we have referred in this article. Our sense of suffering endured in the recent famine, when cultivation was at a stand-still for want of water, is at present too keen, to allow us to look with complacency on such waste as is now going on, or to allow us to contemplate working officials struggling against an old, deep-rooted evil, without lending them all the countenance and assistance which it is in our power to afford. Larger crops than are now raised, can be reaped from Madras fields. We have heard a story of a man who obtained about 160 acres of average valley land, which when it came into his possession was burthened with a debt of Rs. 40,000. He took up his residence on the land, determined to cultivate it himself. He did so, with the consequence that he has paid the entire debt, saved money, increased the produce of his land by 48,000 Madras measure, or 700lb. of paddy per acre, by adherence to the principle of using and not abusing the water-supply at his command. What this enlightened man has done of his own motion, the State, as landlord, ought to compel its tenants to do. If it cannot make its tenants wealthy, it ought, for it can, prevent them wastefully cultivating the land it leases to them. As matters now are, the State shares th blame with its tenant.—*Madras Athenæum.*

CEYLON TEA: MR. CHARLES SHAND'S PATENT PROCESS OF PREPARATION.

CINCHONA may be king among our new products, but it is every day becoming more evident that tea is to be a close rival. Abundant crops of the fragrant leaf whose decoction affords the universal and ever-popular English drink may afford steadier and even more reliable pecuniary returns, than the rich bark of trees which can only be stripped or utilised at considerable intervals. But the great advantage of cinchona is that while its culture proves a most important supplement to, it does not necessarily interfere with, either tea or coffee cultivation. Tea in Ceylon is more likely to be a rival to coffee, and to become the more favorite and, in some cases more profitable pursuit of the two. Especially will this be the case if the continuous anxiety to improve the preparation which is manifested on every hand brings us to the result now fairly anticipated of Ceylon tea acquiring a peculiarly high, and perhaps pre-eminent character in the English market. It is quite animating to witness the healthy, if not keen competition, which has already sprang up between different tea planters or rather manufacturers in this Colony. The jealousy manifested for the reputation of our island teas is most ardent and commendable. "It is tolerable and not to be endured," as Dogberry has it, that one extensive shipper should hazard the still budding repute of the infant tea colony in Mincing-lane, by sending thither preparations liable to be confounded with "common Java!" While if the inquiry should be raised for the best local tea, we have immediately claimants from East, South, North, and West ready to produce high testimonials, each with his circle of drinking admirers and regular customers, and better still, backed by the independent certificates of experts in Assam planters, China merchants or London tea-tasters.

All this is as might be expected. The planting colonists of Ceylon when they once go at a new industry, do nothing by halves. When the impulse has once been given and fed by the promptings, the advice and practical information which can be brought to bear through these columns, our planters, we are thankful to say, do not stand long in doubt of what, they should do. They do not wait on the Government, or call on Hercules, but put their own shoulders to the wheels. In this way can we account for the rapid and magnificent development of the planting industry which the Central Province of Ceylon has witnessed during the past generation. And the results of watchful experience, shrewd observation and keen interchange of criticism and suggestion are now seen in the advanced state of all our tropical cultivation, and the attention given to tropics seldom mentioned, much less treated practically, anywhere out of Britain. Mr. Hughes told us repeatedly he was quite astonished to see the amount of attention given to scientific culture, theoretically and practically, among the planters of Ceylon. But even more striking than the improvements in culture, are those in the machinery, and all the other various means needful to secure first class preparation for our staple. The high position of Ceylon plantation coffee in the European market, as compared with Rio or Java coffees, is sufficient evidence of this fact. In preparation we excel. But the comparative state of perfection now experienced was not attained in a day. One by one were the improvements introduced, and chiefly by practical planters, in the estate store, in pulping machinery, cisterns, barbacues; as well as in the machine peelers, winnowers, and sizers, and in the picking and thorough drying which distinguish preparation in Colombo.

It is not to be the same with tea? Shall we not have "the battle of the pulpers," which for years afforded a fertile subject of discussion in our columns in another form in connection with this new product? And may we not anticipate that the outcome will be such an improved system of preparation for the tea leaves both on the plantations and in Colombo, as shall establish for our produce a standard of superiority over Java, China, and even India teas?

To-day through the courtesy of Mr. Charles Shand, we are in a position to call attention to one of the earliest and, perhaps, most important improvements to which Ceylon is naturally to give birth in connection with its tea enterprise. We need scarcely say that planters and others interested in the cultivation of tea in Ceylon, are surprised, and frequently disappointed with the great divergence in the reports of London brokers on the qualities and values of the parcels of tea which have been sent home from time to time, from the same estates here. On one occasion it may be the make of the tea, the colour and strength of the liquor are all that could be desired, and the valuations most encouraging; at another the tea is badly made, and the liquor is miserably thin, and wanting in pungency, and the valuations of the same descriptions are reduced from twenty-five to fifty per cent. But when we consider the circumstances which at present attend the manufacture of tea in Ceylon, surprise at the absence of uniformity in the quality of the produce of the same estate or of estates at the same elevation altogether disappears. As a rule, tea is being cultivated here by proprietors whose knowledge of all that concerns the manufacture has been picked up chiefly from books. In two or three cases tea-planters from Assam have been engaged to manage estates, and these have taught a certain number of kanganese and coolies something of the process. Many of these coolies again have found their way to other tea plantations, and thus to their care, skill, and judgment many of our tea planters are dependent for the proper manufacture of an article peculiarly susceptible of injury on the two essential points of fermentation and firing. In India, where both managers and coolies have through long experience become thoroughly acquainted with the delicate process of firing, and where all possible conveniences can be afforded on a large scale, it is possible by great care exercised in the dholing-house, to reduce the injury to the quality from over or irregular firing to a minimum, but there is no doubt that in spite of all precautions and watchfulness, some injury takes place, arising from carelessness or ignorance of coolies, or why should there be so great a desire on the part of Indian tea planters, to find some method of firing tea, which would obviate the necessity of so much dependence on the care and judgment of the labourers employed in the dholing-house? Few Ceylon planters have any acquaintance with the delicacy of the operation of firing teas, but most of us know from experience, how difficult it is to get coffee roasted to a point fit to drink. What wonder then, that so many samples of the tea sent from Ceylon are condemned for not being properly fermented, or for being more or less burned. The injury from the first cause can only occur once in making tea, and may be more easily guarded against, but as tea is fired and refired, every repetition of the operation aggravates the evil.

All this being generally acknowledged, our readers, and especially Ceylon tea planters, will be glad to learn that a process has been invented by Mr. Shand by which tea can be manufactured very much more economically and efficiently, without the aid of charcoal or the direct action of fire heat. The necessary forms having been complied with, a patent is about to issue to Mr. Shand, so that the specification will shortly be available for publication and a simple inexpensive machine embodying the principle may be ready for inspection in a few days. Meantime it is enough to say that through its agency tea planters will be rendered independent of professional skill or special care in the dholing-house, while of the satisfactory nature of the work performed evidence is afforded in the following correspondence and report on the first samples of Ceylon tea made under the new process:—

City Chambers, Railway-place, Fenchurch-street.
London, 23rd May 1879.

The second lot of tea, samples turned up two days ago, and I went straight off with them to Messrs. Thompson when they had a great sampling and tasting. The preparation is pronounced perfect; and the tea first chop in every respect except that the samples get a little "flat" from coming home in paper. To preserve the aroma, &c., each sample should be in lead.

Young Mr. Thompson was especially pleased with the colour of the infused leaves. Send a lot of stuff home up to those samples, and it will sell right well. Enclosed is copy of Thompson's report.

(Signed) W. M. LEAKE.

38, Mincing-lane, 21st May 1879.

W. M. LEAKE, ESQ.

DEAR SIR,—We have the pleasure to report favourably on the last musters from your Ceylon estates. The leaf on the whole is better rolled, and there are more Pekoe ends; but the chief improvement is in the fermentation and curing, which have been successfully carried out, giving an

even bright leaf after infusion, and a rich full flavoured liquor. The samples have neither freshness nor aroma, but this is probably owing to their being packed in paper.

Such teas as these, we think, would find a ready & here.—We are, dear Sir, yours faithfully,

(Signed) WM. JAS. and HY. THOMPSON.

With this comparatively preliminary experience of the new process so favourably spoken of, a notable success may be anticipated when the patented machines are in full working order, and it gives us the greatest possible pleasure to find a veteran colonist like Mr. Shand, who has been so long identified with our progress both as merchant and planter, leading off with the first patent for improvements in tea manufacture in Ceylon. We hope his patented invention will bring him a due reward in direct 'royalty' while indirectly both in the case of his own plantations and in those of others, it enables the Ceylon produce to "top the market." Mr. Shand's principle, we need scarcely say, is found in the application of steam, and the advantages he claims for his invention are, we believe :—

1. That it obviates the use of charcoal or other risky means of firing.
2. That the quality of the tea is greatly improved and made more uniform as it cannot be injured by careless firing.
3. That the cost of fuel will be trifling, as prunings, dried weeds or dried grass or any wood unsuited for charcoal can be used.
4. That where steam engines are employed for rolling machines, or on premises where teas can be refired as in Colombo, no expense for fuel need be incurred.
5. That as the machines can be made of any size the smallest quantities to the largest may be made daily.
6. The cost of the machines will be small, depending on the quantity of tea required to be made—and moreover, in wet weather fresh picked leaves may be withered in the machines.

We have no doubt that further contrivances and inventions to improve the manufacture of tea, as adapted to local wants, will follow the present improvement until, before long, Ceylon becomes as well-known for its superior tea as for its unrivalled coffee preparing machinery.—*Ceylon Observer.*

THE PRESENT CONDITION OF INDIAN AGRICULTURE.

THE following paper was contributed last April to a *Gazette* (edited by the students of the Agricultural College, Cirencester), by Kumar Gajendra Narayan, Jr., of Kooch Behar, who is studying at the College. The clear and simple account that it gives of farming in India will prove interesting to English readers, and we are glad to have received permission to reprint it. The Kumar is Honorary Secretary of the Debating Society of the College.

As no one has ever attempted to write anything on the above subject for this *Gazette*, I take the first opportunity of writing a few words on a subject which is very important for the Indians and people in general destined for India. I have come across some of my fellow-students who are either to spend the best part of their life under the tropical rays of the sun, or at least who express a desire to go to India and make a fortune. This subject doubtless would have been better treated in a proper hand, but I regret no one has ever thought of it. My sole intention in selecting a subject like this is to give an idea to our future planters or farmers of the system of agriculture existing at present among the Indians.

The climate of India is hot, but the weather, unlike that of England, is certain. We know when it is going to rain and we know when it is going to be fine. By counting the number of months since the beginning of the new year, we can say when we are going to have dry weather, with a pleasant breeze, and when we will have cold days, but with a bright, pleasant sun. I must confess that sometimes our calculations are wrong but certainly it is not our fault, but simply an exception to the general rule and is always an unnatural or unusual occurrence.

During the latter part of autumn, the places which were flooded in last summer are restored again to their former conditions with some additional new soils—the alluvial deposits—which are brought down from the hills by those big rivers which drain the Northern, Southern, Western, and Eastern parts, and in fact the whole of India. With the end of autumn and the beginning of winter come the pleasant days for enjoyment, either in town or in country. Men fond of society generally prefer the former, while men full of sports and activity generally the latter. This course of things continues till about the middle of spring, when the people begin to return home. At about this time we also get occasional rains, which we can always keep clear of by observing the accumulation of clouds over our head. The spring is soon over, and then comes the summer, the early part of summer being the hottest part of the year. During this period we seldom have any rain, and not a single speck of cloud to be seen in the sky. This is the time when some of the districts get so hot under the scorching rays of the sun, especially places far out from the sea, as to injure the prospects of the inhabitants by burning up the growing crops. This scorching heat is followed after some time by showery rains, which continue in some places sometimes for hours and hours without ceasing. Rivers soon overflow, and tanks, pools, and even the fields which are not protected by any artificial mound or embankment are soon flooded, and huge native boats are seen sailing over the paddy, Indian corn, and other fields ; this generally happening lower down the rivers in such places as Bengal, Orissa, or Sindh.

The system of land-owning is as follows :—A big landholder, or zemindar, as he is generally called, holds a certain number of villages, say one hundred, and the land about the villages, directly under the Government ; under this zemindar there are some smaller zemindars, who most probably have four or five of these villages each. These petty landowners are liable for rent, taxes, and other things connected with their estates to the zemindar under whom they hold their estates. But the destination of the land is not fixed yet. There is in each village the Chief or Mundal, who holds the village under the petty zemindars, and these Chiefs or Mandals are liable to their landlord for the rent of the village and the land about, and answerable for the conduct of the villagers, and in fact the management in general of the village. He acts as an interpreter between two rivals ; sometimes even goes so far as to interfere with their religious rights, and especially in some parts of India this practice is greatly carried on. Then this Chief again divides the land among his villagers, retaining a small portion close to the village for his private purposes, and which is generally kept in order by his servants. This small portion of land he frequently turns into a kitchen garden. The land which is held by the villagers under the Chief might be under one of two conditions :—Firstly, that the produce will be divided into two equal parts ; if the villager used his own ploughs, oxen, &c., one of these will go to the villager and the other to the Chief ; in cases where the Chief has provided with every necessary, implements, &c., the produce is divided into three equal parts, two of these going to the Chief and the third to the villager. Secondly, when the villagers hold a certain piece of land rent free, they must do a certain amount of work for nothing, under the direction of the Chief or person authorized by him. Both of these conditions are in themselves faulty. In the first instance, where the produce is equally divided, the villager evidently takes very little care for the future welfare of the lands as long as he gets a good dividend ; he does not care whether he exhausts the land or not. He goes on working like this until he finds that the produce does not yield a good dividend, then he gives up the land and takes another piece. If he is particularly an over-exhausting man, he soon does the same thing to this piece also ; and as these men don't make more than 16s. or 20s. a month, they can really effect very little improvement in the land. In the second instance, where the men are to work under the directions of the Chief, it matters very little to them if their Chief suffers from failure of the crop which was grown by them on the Chief's own land under his directions. And as these Chiefs are also poor in their capital, they can hardly do anything by which they might improve the fertility of the land ; and if by chance some Chiefs have got a somewhat larger capital, they don't know how to restore the fertility to the soil or effect any improvement in it.

There is hardly any stock kept by the Indian farmers (if I may be allowed to use the term), like their brother farmers the Europeans. In the country higher up the Ganges, also in Madras and Bombay Presidencies, a dozen or two buffaloes and a few milking cows are seen in the villages, according to their sizes. A few goats are also sometimes seen about a village, which are generally kept for the markets ; but they get nothing like the treatment which animals kept for the same purpose do in England. They are usually taken out of their pens in the morning, either with a rope round their neck or else loose ; then they are driven into a field, where they are either tied to pegs driven into the ground or let loose as the case may be ; and then in the evening they are driven back to their pens.

Sheep are rarely seen in villages, and especially those round a town. Pigs are not to be seen in villages forming a part of the poor stock, but they are kept only by a sect of people, whose business is to keep pigs, make mats, sweep, &c. This is the lowest and poorest sect of people. If the village is a Mahomedan one, fowls will be seen, and with them a few ducks. On the contrary, if the village is a Hindoo one, no fowls, but a few ducks may be seen, which are usually for the private use of the owner. Horses are not to be seen as stock ; but if the Chief be a swell, a pony might be seen at his door, either for his own use, or for his son's use, if he has any.

The crops generally in India vary according to the soil and the relative position of the land, either to the sea or the mountains. In the dead level plains of Bengal, and more particularly in the lower provinces rice is greatly grown, and forms the staff of life. Wheat is grown universally and profitably all over India, so are also the potatoes, which generally flourish best in the hills, and especially at Darjeeling, which has given a name to a variety of potato grown in the district. This variety (Darjeeling potato) grows to a good big size, is a heavy croper, and closely resembles the Scotch Regent in other particulars. Indian corn, linseed, mustard, beans, castor-oil plants, and many other grain crops are also usually grown in India. The poppy from which the opium is obtained, is under Government monopoly. It is largely grown in Behar, and the opium is mostly imported to China, which adds a great portion to the Government revenue. Tobacco is grown in most of the districts, and so is cotton; but the latter is mostly confined to the hills, whilst the former generally prefers a damp climate and the soil light sandy. The Bhutan Hills are famous for cotton growing. Calcutta harbour is full of this cotton, whence it is shipped and sent to Manchester, and turn into cloth.

The general method for getting ready a piece of land for any of the crops is very simple and poor indeed. They plough it with a wooden plough, pulled by two oxen, the furrows being far from regular. The depth usually ploughed is about two inches, three inches being the greatest. These wooden ploughs are triangular in shape, and are quite different to any of

the ploughs manufactured either in England or in America. These ploughs can never thoroughly plough a field; when they make the first furrow, of course the furrow get a triangular shape, the earth instead of being thrown on one side is thrown on both sides of the plough, and thus ridges are caused to be made on both sides of the channel. Then when they come back, however close they may drive to the first furrow, they always leave a space unploughed, or if the man be a very expert one he might just skim it, but by no means plough it properly; so some of the ground is always left unploughed, however carefully the work might be effected. Then if the land be a heavy one, they have wooden mallets, and with these hit the lumps of earth right and left, and thus break them. Then comes the operation of rolling, and thus breaking the small lumps of earth as well as levelling the ground. This operation is done by means of an implement which you can hardly call roller, because it is not a roller, although applied for the same purpose, but in fact it is a ladder, either wooden or bamboo, pulled by two or more oxen. Two or three men get on this, and thus partly by their weight and partly by the knocking about which the small lumps of earth get, they are broken, and their object attained. Then they collect the weeds and stubbles and burn them, and spread the ash on the field. Besides this ash manure, if the land be intended for either tobacco or potato crop, they apply some dung also; the quantity of dung not exceeding ten or twelve baskets-full per acre, which hardly comes to one cart load. This dung, if it is for tobacco crop, is heaped in different spots on the land, and then when the plants are planted, they heap the dung round them; but if, on the contrary, it is for potato crop, it is, applied when the ridges are made, the ridges being made by spade labour. The crops when ready are harvested with a sickle, and after the usual harvest the crops are stacked, not on any stack-stand, but on the ground. Then comes the most interesting operation after harvesting, the threshing. This is done usually as follows:—The crop is laid on a piece of ground, in a circular form, then six or seven oxen, as the size of the piece of ground may allow, are made to walk round and round on the crop; thus the seeds are separated from the straw by the trampling of the oxen, but not until some time has elapsed. Then they have not got any winnowing machine, but they take the first opportunity which the wind might allow them for this operation. Now all the operations are over, *viz.*, sowing, harvesting, threshing, and winnowing, and the produce is now stored in a store-house, from which it is taken to the market, whenever there is one, and sold.

The Indian farmers (as I have entitled them previously) owe the return of their capital, together with the interest on it, not to their labour and system of agriculture, but to the natural fertility of the soil, which they are ignorantly exhausting continually, and to the cheap wages of the labourers, the wages not exceeding more than threepence a day.

I have tried to explain some facts in plain words, though I doubt as to its being so or not; and if the facts are clearly put, my readers will at once see that the present state of Indian agriculture is distressing, and wants some improvements I have no doubt many of my readers have been noticing for the past eight or nine years the serious distresses in India, either from the natural causes (as Balasore flood) or from famines. I think some of the causes of famines are quite out of our power, whereas some lie with the people. In conclusion, I have only to say that the "Present Condition of Indian Agriculture" is very deplorable, and improvements should be effected if India is to prosper, either in the increase of population or commerce.

KUMAR GAJENDRA NARAYAN, JR.,
Of Kooch Behar.

—*Journal of the National Indian Association.*

MANURING LAND WITH FOSSIL SHELLS.

THE *Philosophical Transactions of the Royal Society for* 1744 record a very successful innovation in manuring. Near Woodbridge, in Suffolk, there were very extensive deposits of fossil shells, consisting mainly, it is stated, of the common whelk. The narrative continues in the following words:—"The farmer of the ground has, it seems, laid the foundation of an ample fortune from them. He contented himself in the old beaten track of the farmers until a happy accident forced on him a bold experiment. He used to mend his cart-ways, when broken up by harvest work, with these shells; in which business his cart one day broke down, and threw the shells out of the cart track into the cultivated part of the field. This spot produced so remarkable a crop the next year that he put some loads on a particular piece, kept the secret to himself and waited the event. This trial answering expectation, he directly took a lease of a large quantity of poor land, at about 5*s.* the acre, and having manured it heartily with these shells, in about three years it turned to so good an account that he had 15*s.* the acre proffered to take the lease out of his hands." This procedure has been successfully imitated, as many of our readers are aware, in the use of coprolites, or fossil dung of animals, as manure. These coprolites are especially abundant in Suffolk.

THE VALUE OF COCOANUT ESTATE PROPERTY.

THE following inquiry from a low-country planter has been lying by us for some time:—"In your review of the planting enterprise of Ceylon you give a valuation of the cultivation of the island and take the value of coffee to be £30 per acre, tea £25, and cocoanuts £60. Now in this you have taken, and very properly, an average value, throwing all the coffee in together. Do you consider that £60 is a fair average value for cocoanut estates per acre? May I ask on what you base your figures for the product. I ask because other planters besides myself know little of cocoanut cultivation; and if twenty-five nuts per tree per annum and seventy-five trees to the acre is correct or even double that number of nuts, I can't see how you got that high value for an average." We accept a yield of 25 nuts per tree per annum and 75 trees per acre as fairly representing the average condition of cocoanut cultivation for the island, and still we feel inclined to adhere to our valuation of about Rs. 600 per acre. Our correspondent must remember, however, that the valuation is not based on the mercantile return, but on the actual value of such property in the eyes of natives. Unlike coffee, cocoanut palms have a permanent value in the estimation of people of Ceylon, and they will not scruple to pay a long price for planted land without giving much consideration to the rate of interest the investment will yield to them. Their outlay, too, is exceedingly low in cultivation. So that if they get a return of 3 or 4 per cent., we suspect they are satisfied. It is the same to a great extent with house property. How few native landlords in Colombo make 5 per cent. on their capital. In cutting down cocoanut palms for public purposes, the value, we believe, is usually put at ten rupees a tree apart from the land.—*Ceylon Observer.*

SUMACH.

THERE are at least seven different trees and plants called Sumach.—Chinese, Common, Dwarf, Poison, Smooth, Staghorn and Venetian—all more or less useful for tanning leather. The Smooth, *Rhus glabra*, is the best, having about twenty-six per cent. tannic acid. The Dwarf, *Rhus copallina*, is next, having about twenty-four per cent. of the tannic acid, as near as I can find out The leaves are mostly used; some break off the small green tips with the leaves on, but the buyers do not pay as much for it if there are many twigs in it. It is best to gather only the green leaves, as they dry quicker and can be put away under cover or sacked for market without as much danger of being injured by storms if the drying is in the open air. To bring the best price it should be very dry and of a bright green colour. Sumach grows in all the old fields and around on most of the ditch banks. A good hand will pick and dry in a bright day 75 to 150 pounds under the disadvantage of forcing his way through cat briers and brush. It is ground here by wooden mills made for that purpose. If it is dried in the sun it should be stirred and turned every few minutes, or it will turn brown. It was sold last year at 65 cents. per 100 pounds, costing the millers about 75 cents, The year before it cost the grinders 1 dol. 30 cents. About 1,400 tons were bought in Petersburg in 1877. One firm in one day received 8,000 pounds.

I have not learned how much was received this last year, but not as much as the year before. The gathering begins as soon as corn is laid by—about the first of July—and it is kept up till frost, or till the leaves turn red. The greater part is gathered in August and September here, and mostly by the negro population. Last year it sold, after it had been ground and sacked, at 50 dols. to 60 dols. per ton for export. It is mostly used in tanning glove leather and other finer leathers.—*J. D.*, in *Country Gentleman, U. S.*

NATIVE OPIUM CROP.

(*From the Press Commissioner.*)

Report on the Native Opium Crop in the Consular District, comprising the three prefectures of Ning-po, Tai-chow, and Shao-hsing.

DURING the past season, careful and diligent inquiry has been instituted, through acquaintances among Chinese merchants, officials, and others, with a view towards obtaining more certain information on several points respecting which Mr. Hillier, who wrote last season's report, could do little more than speculate. Our efforts to possess ourselves of more certain statistics of the crop have proved fruitless, and I am able but to furnish my own idea of its amount, founded on the reports of persons who were all, more or less interested in understating or overstating it; dealers and others engaged in its transport and distribution asserting it below what they really knew it to be, in order that the selling price might be maintained, and the taxing offices blinded. While officials had little or no certain information that they would impart to me, the people interested in the sale of Indian opium I found prone to exaggerate the crop, with no other view, that I can discover, than to account for its low price as compared with foreign opium, and as a cause for railing at the Magistrates for their inertness and disregard of the prohibitions against its cultivation. One result of my inquiry, however, has been to place beyond a doubt the

connivance of the whole body of Government officials of the Tai-chow prefecture, and that arrangements were made with them in the autumn of so satisfactory a nature to the farmers and capitalists, that the farmer placed at least half as much again of acreage in poppies than they had done in any previous year, and that the latter agreed to purchase the opium produced, with intent not only to store, but to work and prepare it for market; it having been found that by keeping, manipulation, and drying, it acquired a better flavour, and fetched, when put on the market, so superior a price as well to repay the interest of the money invested and the labour employed on it. The Tai-chow produce, as it has heretofore come to this market, in its raw state, adulterated with spirit, resinous, and other substances to the extent often of 20 per cent., has come to great disadvantage. The crude burning taste of fresh opium which may be tolerated in cold weather, is found at the commencement of the heats of summer by all but the lowest class of smokers extremely objectionable. The rate at which growers are to fee the Magistrates' staff I have not been able to ascertain, beyond that in every local district a local rate has been determined, by means of which agreement between the cultivators and the runners is facilitated. The war contribution office collection is 60 cash a catty (between two and three pence per pound.)

In addition to these facts it may be assumed that the authorities at Tai-chow are not taking upon themselves to set at nought the Government edicts against the cultivation of opium, without some understanding, tacit or otherwise, having been arrived at with the provincial authorities at Hang-chow, (who very probably, being hard pressed by the central Government for remittances, see how greatly an increased growth of opium will, in view of the diminution to which, of late years, the Shen-si crop has been subjected, benefit the provincial revenues.

At Tai-chow the season was a very favourable one. Apart from what is required for local consumption, the quantity that will be set down on the market may be calculated at over 30,000 catties. Very little of this has as yet come to Ning-po, and what has come has been of the usual watery kind, which, after being boiled, filtered, and evaporated, leaves a large quantity of cinder in the pipe. The price has fallen from that reported last year to below twenty dollar cents. the tael.

In the Ning-po prefecture the poppies did not thrive so well as in the country to the south of it. Late into the season there was snow and cold weather followed by an unusually bright spring. Though the plants were tall and flowered well, the capsules were small and yielded poorly. The quality of the Seang-san is better than it usually is and of a thicker consistency; at Ning-po it has found a ready sale at 20 to 25 cents. the tael.

The other districts of this, and also those of the Shao-hsing prefecture grow opium only for their own consumption. Seldom, if ever, do they send any but to the market of the township.

Last year's Tai-chow opium, of good quality, has, during the winter and spring, commanded a price varying from $1 to $150 per catty.

At the present relative prices of Patna and Malwa, Patna, which opium is generally considered the superior as regards flavour, is cheaper than the latter if the price be calculated by its intoxicating qualities. Some cause for its not being more preferred by the smokers at the places supplied from this port is, that they are already supplied with the brass vessels for converting the raw drug into the preparation for the pipe, and do not care, to replace them with the larger ones that are necessary for the preparation of Patna. Whereas, Malwa can be prepared for the pipe in two or three-hours with but small loss in quantity, not more than 20 or 25 per cent., Patna requires attention constantly for at least thirty six hours. The contents of a ball are taken and boiled with water for about twelve hours in an open brass pan, till it becomes in such a state, that, on the water being evaporated, a softish mass is left, the surface of which being scorched, a scum forms thereon. This is removed and hardened over embers on a wire gridiron The operation is continued till the opium in the pan be exhausted, and twelve to fifteen flat cakes be produced. The opium in this form is again macerated in water, filtered, and boiled for several hours, slowly. A substance of treacly consistency is the result. This lengthy process and the qualities of the prepared article being so well known to consumers, appears to have prevented, as yet, any adulteration. In those parts where Calcutta opium is smoked, the preparation seems to be generally done by persons who make a business of it, selling the product of their manufactures in small quantities to suit purchasers. Here, I am told, Patna is only smoked by the wealthy, and in the larger smoking houses. In these parts smokers seem to seek their enjoyment more in the recesses of their private houses than they do in the south of China, where the consumers may be seen to congregate in the public rooms.

The scarcity of Malwa would lead one to suppose that Patna would supply its place. The reason that it does so but slowly is that the custom of of smoking Malwa has become established. Malwa is easily prepared for smoking, and the simplicity of its preparation allows of its adulteration by by native opium and other foreign substances. At a smoking house 140 cash are charged for a mace of Patna, while for the same weight of Malwas 65 or 75 cash suffice. Patna is considered much the more potent of the two; the habit of smoking Patna once formed, extrication is more difficult. It is thought to produce insensibility more quickly, which is a defect, Chinese being desirous rather to prolong the state that precedes it. It is said to be cool to the taste and heating to the vitals,—producing low fever. Malwa has a pungency that ingratiates it to the palate of consumers, and does not affect their constitutions so injuriously. The vapour of Patna is dense. The fumes of Malwa have more tenuity. The better class of opium house do not professedly sell native opium to their visitors; the few which do have no other kind. It is not sold there by the weight, but by the [illegible] (mouth or dose), which is nominally the quantity generally taken by a smoker without rest, and makes from five to eight pipes. The charge for a *K'ou* is 10 or 12 cash, say a cent. The preparation is not supposed by purchasers to be entirely opium.

From a chest of Patna of 100 catties, only from 50 to 60 of the prepared opium is obtained, while from Malwa 70 to 75 catties is the product.

The tests by which the quality of opium is often determined are what may be called the water test and the fire test. The first is a test of its purity. Equal parts of opium and hot water being taken, they are placed in a brass pan over ignited charcoal till the opium is entirely dissolved. The mixture is then run through filtering paper. If it be dilatory in percolating the paper the opium is announced to be adulterated, and its value is consequently deteriorated. This test often lowers the price of Persian, which, often good in other respects, stands this test badly. I need not say this test is inapplicable to Patna and Benares. The fire test is subsequent to the drug having undergone preparation for the pipe. A drop is taken on the end of a long needle, and held to the flame of a small lamp. The drop bubbles, swells, and gradually hardens. With the best quality of Calcutta opium, a pale opal film forms on the surface, and a peculiarly subtle and penetrating odour is given out. Drug of this quality has been, of late years extremely rare, and it is doubtful whether it is now procurable in China. The next best shows a bright reddish colour; the inferior sorts a duller and darker hue, and with inferior Persian and native, six-tenths of the roasted drop are cinder.

The extent of country supplied with imported drug from this port has, during the last year, owing to the action of this *Lekin* officials, and to the death last June of the great farmer of inland dues, and their chief adviser, Chen Yu-men, been frequently encroached on along its northern limits by the Shanghai dealers.

Last year's harvests were uniformly good. This spring has proved a fine season for silk. In consequence of the dearth in the north, rice continues high. The province is in a prosperous condition, and its inhabitants in a position to afford themselves simple luxuries.

POLARISCOPIC TESTS OF CANE.

THE following report of Mr. Hedges' tests of sorghum were received too late for insertion in our last :—

Editors, Journal of Agriculture.

Three samples from correspondent C. M. Schwarz, Edwardsville, Ills. Date of planting, culture, &c., not given. First sample—Stewart's Hybrid cane seed, all in the milk.

	Spec. Gr.	1,048,	Pol.	5·78
Mixture cane	,,	,,	,, 1,047,	,,	5·55
Early Amber	,,	,,	,, 1,051,	,,	7·13

Temperature 88 1·2 deg Fahr.

July 31st.—Two samples from J. W. Russell, Boonesboro, Ark, located high on Boston Mountain. No report of soil or cultivation received. Stewart's Hybrid Spec. Gr. 1,052. Pol. 4·47; Early Amber Spec. Gr. 1,060, Pol. 8·33, Temperature 88.

The appearance of the above canes was quite different in color, showing a greater degree of maturity and still lacking in that respect, as I presume the next polarized of same lot will show.

Some explanation of these figures and terms may be useful to those not familiar with the tables and terms. The specific gravity shows how much heavier the juice is than water, which is 0 Beaume scale (which scale is most common among cane-growers in this country), count from 0 by decimals, juice that has a specific gravity of 10 deg. B. is about the same as that of 1,080, which will be found, if of good quality and well handled, to make sugar. The above polarizations of the Early Amber cane especially make good showings, and the other varieties may yet improve much by ripening.

The progressive development is an important indication, as the first saccharine in all cane is glucose and afterwards cane sugar. If the above figures represented pure cane sugar present in the juice and it could be all obtained without loss in manufacturing, the 8·33 would give some twelve pounds sugar to the one hundred pounds juice (which is about eleven gallons juice), as all juices of that richness will weigh [illegible] nine pounds per gallon. The polarized is more especially useful as showing the relative merits of the different varieties of these canes one with another, than the actual per cent. of cane sugar present. The quantity of cane received, therefore, is too small to allow other qualification tests to be made; but as Mr. Schwarz's cane is quite forward, we shall soon be favored with an ample supply. He has some seven or eight varieties, all doing well. He has also the Pearl Millet of fine growth. He informs me that he is now putting his works in order, and will soon make his first experimental field tests, the results of which will be published in the Journal of Agriculture, and may be of much value to new beginners, as Mr. S. may be considered not only scientific, but mathematically correct—and what he fails to find out with the assistance of our expert, is hardly worth knowing.

He has planted for me some of what I shall name Amber Liberian, that seems to give fine prospects in an abundant growth. Should its saccharine be also abundant, it will become a desirable acquisition to our stock of canes In most sections Early Amber does not grow large enough, and although its juice is rich, there is not enough of it. Most persons say: We need a cane that will yield 200 gallons heavy syrup to the acre—on medium soil with good cultivation—to render us satisfactory results.

I will say something about idle cane mills about the country, with a view to having them put to use. If persons having such will write to me, giving description, size, and length of rollers, whether vertical or horizontal, and whose make, as well as price on board at railroad or boat, I may assist them in selling them. Some would buy a second-hand mill who do not feel able to purchase a new one.

Before closing I will say that correspondents in sending cane hereafter, will please not send less than ten to fifteen ounces, and will cut the cane so as to leave a joint on each end of the canes so sent. It costs only one cent an ounce to send the cane by mail. The report of the condition of the crop all over the country is generally favorable. I wish to return my grateful thanks to Messrs. Kingsland, Ferguson & Co., for furnishing me gratuitously a small mill for pressing the juice for my polariscopic tests.

I. A. HEDGES,
COR. SECY. M. V. C. G. A.

THE RUSSIAN CORN BEETLE.

THE *Globe* learns from Odessa that upwards of 12,000 machines are now engaged in South Russia in the task of extirpating the corn-beetle. The most popular machine is that of Gospodin Sokonin's invention, of which 5,000 are in use in the provinces of Kharkoff, Pultova, and Ekaterinos. The Zemstvo of Marianopol voted last week 30,000 roubles towards the purchase of corn-beetle machines, and the Zemstvo of Kharkoff 80,000 roubles. The ravages of the pest are on the increase. The Odessa *Vestnik* says :—"A new visitation is telegraphed to us from Pultova. A number of fields bearing upon them as fine a crop of wheat as a farmer could desire, suddenly changed their appearance, and in a few days presented an aspect of having been subjected to a devastating hailstorm. An inspection by a Government naturalist showed the cause to be the ravages of that dreaded *Cecidomya destructo*, or, as people call it, the Russian fly. This pest, which caused such terrible devastation in Southern Russia at the beginning of the present century, received the title of Hessian fly because it was imagined that the Hessian mercenaries had brought it with them from America, where they had been engaged in the War of Independence. Subsequent investigation reveal, however, that it had existed sometime before their advent. Still, the name has always stuck the insect, and until now it has never appeared east of the Russian frontier. The havoc it makes is so dreadful, and it multiplies with such amazing rapidity, that the authorities at Odessa have despatched the well-known specialist, Professor Lindemann to the spot."

CORN BEETLE MACHINES.

IN a letter from Odessa a correspondent of the *Golos* gives some particulars of a public trial that has been taking place there of machines for collecting and destroying corn beetles. The investigation was carried on in the presence of delegates of the provincial assemblies of Kherson, Pollava, Bessarabia, and Penza, presided over by Professor Lendoinan, zoologist, of the new Russian University. The number of competing machines was 18, of which the majority were more successful in destroying the corn than the beetles. After numerous experiments, three only were selected as fulfilling the conditions imposed by the committee. Wagner's machine, Yavorsky's, and the machine employed by the Odessa Zemstvo. A trial then took place among these latter, resulting in the preference of the committee being accorded to the machine of Herr Wagner, which in its course through a cornfield destroyed 70 per cent. of the beetles on the stalks. Wagner's machine is very simple. It consists of a large comb, 81in. long, the teeth of which are edged with bristles and covered with a metal shade or elongated umbrella. The workmen, pushing the apparatus before them, clear the beetles of the ears of corn. Under the metal shade are two lathes, edged with bristles, which clean the beetles off the keth and transfer them into a wooden receptacle beneath. One of Wagner's machines, without difficulty, can operate upon 20 or 30 acres of corn a day. Great satisfaction is expressed at its success, and not without reason, as the whole country is overrun with the corn-beetle, and the pest enlarges its ravages every day.

THE "NUISANCES" OF OLD ENGLAND.

A GENTLEMAN writing from Leamington, describes England as it is, and Mr. Mechi, writing from Essex, describes England as it ought to be. Under the influence of depraved taste, selfish habits, wasteful excesses, and an unpatriotic indifference to the future of our increasing population, Warwickshire, it appears, has been allowed to fall into a state which is at least a gross anachronism. It has gone to deep grass, to thick, bushy hedgerows, to forest trees everywhere casting their pernicious shade in all directions to streams meandering at their wasteful will, in a word to everything that can impede agricultural operations and deprive them of just reward. It is too true that from any moderate eminence in our Midland counties their is nothing to be seen but tall timber and endless hedgerows, burying the fields out of sun and sight, with only here and there the lighter green of some rising ground, the flash of a winding stream, a church or a mansion. On strictly economical principles, and to the calculating eye of a visitor straight from the valley of the Mississippi, this is a sin and shame. As to the quantity of soil, surface rainfall, and sunshine absorbed and monopolized, it is enormous. An ordinary parish of between two and three thousand acres will often contain thirty miles of road and lane, as many miles of river and water courses two hundred miles of hedges, about half of them being also hedgerows—that is, containing tall trees, which, after all lopping and polling, have good large tops and roots to be come upon everywhere about them. There are thousands of such parishes in the districts where property remains in many hands, and where each dairy stands, of necessity, in the midst of its hundred or two hundred acres. But when we reckon the economical loss, we begin to respect the groans of our friend hailing from Illinois or from our own Australia. Upon a moderate calculation of the breadth of land taken up those nuisances, as they are in a certain sense, it is not too much to say that they deduct at least ten per cent. from the productive power of the land, besides their mechanical interference with field operations. Even under the humblest system of agriculture they render abortive, and therefore destroy, labour, seed, manure, and are answerable for at least half the wear-and-tear of horses, men, implements, and other gear. It is at the turnings, not in the straight course, in inequalities, not in the open and smooth ground, that the team gets into difficulties. It is evident that a great deal has to be polished off the face of Old England before it can competes successfully with the new corn-growing countries. It is too heavily weighted for the race.

MANURING WHEAT AT SOWING TIME.

IN your issue of June 26th, Codnor wishes me to give my mode of top-dressing. In my articles preceding, I insisted on the necessity of such a course, and the season approaches for putting out our wheat crop, at which time I top-dress for the two-fold purpose of getting a good wheat crop and a sure catch of grass to form a permanent sod. I do not attempt to top-dress unless I have fine manure. As the season is past for making manure for this fall's use on wheat, I will not give my mode of preparing it now, but will give details on this point in a future letter. My remarks on top-dressing for this crop will not benefit Codnor much if he has used his last winter's stock of manure for other crops, and has only summer-made manure for this fall's use. I will take for granted that last winter's manure has been carefully prepared and piled up, convenient to haul as soon as the wheat ground is plowed. I also take for granted that the rotation of corn, oats, and wheat is practiced, as here. Although I do not regard this as the best chance for wheat, yet circumstances seem to force us into this rotation, and I will not now urge my views against it.

As soon as the oat crop has been removed, or even while the shocks are in the field and not in the line of the plow, I mark out my lands seven or eight steps wide, and back furrow four rounds on each one ; then commence hauling manure, and drop it in piles about fifteen feet apart, so that thirty good two-horse loads will go over an acre when spread evenly. It is easier hauling over the field before the plowing is all done. Do not fear that the manure will waste any if put in snug heaps. After the manure is all out, finish plowing the field immediately, and let it lie until sowing time. The longer the field remains after plowing, the better, as it will give time for the oats to sprout and grow before sowing. I always plow as soon as possible, so as to get my wheat in by the first week in September, or not later than the middle of the month, and the ground should be plowed four weeks previous if possible. When the oat stubble is well turned under out of sight (which it should be in all cases), there will be no hindrance to spreading and harrowing in the manure. Spread evenly well out to the dead furrow of each land, and before any harrowing is done. When one land is spread, give it a brush with the harrow, and then follow immediately with the roller or clod-crusher ; then let it remain undisturbed until the whole field has been gone over a land at a time in this way. Then harrow thoroughly with a slanting-toothed harrow, both ways if necessary, but do not use a vertical-tooth harrow unless unavoidable.

As soon as the field is well harrowed, roll down and drill in the wheat. If the land is cloddy, the roller or clod-crusher should be used while the harrowing is being done, so as to get the surface as fine as possible. The crusher is best to grind up the lumps. I pay great attention to fining the surface for all my crops. If the weather is dry when wheat is drilled in, a roller should be run over it after the drill. This will press the seed in and hold moisture. It also packs the manure and soil together, so that the best results are obtained from the manure. Any one not used to this mode of applying manure, will wonder where all the bulk has gone, as the most of it will be hid from sight, and incorporated with the soil to the depth of three inches. If the soil is good, the crop is sure when other precautions are observed, such as leading off all surplus water, &c. By this process, timothy sowed in the fall with wheat, will make a rank growth and lessen the yield of grain, but will insure a grass crop, and no failure, if seed enough has been used to give an even catch. If a good wheat crop is very desirable, it is best to wait until spring before sowing the grass seed, when clover can be sown also if desired. I now adopt the latter course, and do not fail of a good wheat crop, and the grass comes sure also.

Some will ask why I use a slanting-tooth harrow. It is because the work is more effectually done, as every time in passing over the teeth cut and press the soil, and anything on the surface is drawn down into the soil, cut by the teeth and evenly distributed. If manure is applied on the surface to the depth of three inches, I can work it all nearly into the soil, so that little would be seen on top. It is not so with vertical teeth, as in passing over they loosen and bring the tops to the surface, and do not cut them, but pass over and push aside the material we so much wish reduced to fineness. The only use I have for a vertical-tooth harrow is to bring clods to the surface so that the smoothing harrow, can cut them, and the roller and crusher break them. I sometimes go over cloddy ground with the roller, which breaks up many lumps and presses the rest even with the surface. Then I use a slanting-tooth harrow, which will cut the lumps which are bedded in, thus giving the slanting teeth their best hold. If any remain, the roller and crusher are again used, and then the smoothing harrow to finish with. This mode will not disappoint any one having patience and perseverance enough to make a good farmer. I may hereafter give some of my views in regard to different kinds of harrows.—D. S. H. in *Country Gentleman*.

THE* MUSACEÆ OR PLANTAIN ORDER.

BY JOHN SHORTT, M.D., F.L.S., &C., Surgeon Major, Madras Army.

From this valuable paper by Dr. Shortt, we take a few extracts.—

Musa Cavendishii (*Chinensis*).—Commonly named the "Mauritius plantain." This is a dwarf species, the plant grows robust and compact; by some it is believed to have been introduced from the Mauritius, by others from China. It is met with in most districts. I have seen it in the Northern as well as in the most of the Southern districts. The plant seldom exceeds five feet in height, frequently it is much under that height, very sturdy, with leaves overlaying each other closely; it thrives well in the plains as well as in the hills, up to a height of 5,000 feet above sea-level. Is very productive, and produces an enormous bunch of fruits, when well grown, that pits or holes have to be dug to enable the bunch to descend below the level of the soil uninjured. Each fruit averages from 7 to 10 inches in length, is of uniform thickness, and ripens of a pea green color. The flesh or pulp has a straw color, having a resemblance to the color and flavor of the red plantain. It is sweet and well tasted, the rind moderately thick.

Musa textilis or *Manilla Hemp*.—The fruit of this species is small resembling in general appearance that of the Rustalli. It is not fit for food, being filled with seeds, but Mr. Thompson, the Superintendent of the Governor's Garden at Guindy, tells me that the fruit contains some pulp which is sweet and well tasted. There are about half a dozen plants growing at Guindy, and the largest of these was 10 feet, but I believe it attains from 25 to 30 feet in height. It yields the finest and best kind of fibres which the natives do not utilize. A variety of this plaintain* has been imported into Southern India in consequence of its fibres. It has not met with general acceptance, as the fruit is considered worthless and not fit to eat. The absence of a machine, and the want of interest in the extraction of the fibres, cause it to be neglected.

Musa Superba or *Hill plantain*.—This is the wild plantain, an ornamental and handsome plant when well grown. The stem is formed above soil and is exceedingly stout, strong, and conical, exceeding 10 feet in circumference above the surface of the soil, where it is bulbous, and 5 feet at the summit immediately below the leaves. Leaves petioled, but not sheating, is found in abundance about the hills in Travancore, Pulneys, South Canara, and other hill ranges up to a height of 5,000 feet above sea-level. I brought a number of bulbs in 1872 from the "Mukh" in South Canara, and distributed them to the Madras Horticultural Gardens, the Lal Bagh, Bangalore, and introduced it on the Shervaroy Hills, where I have at present a number of plants, two of which are in fruit now. In a couple of months, I hope to have an abundance of seeds for distribution.

The plant attains a height of from 15 to 20 feet, and is very handsome and showy. The flower stem rises perpendicularly and then curves down, the flower bud is large, much shorter and stouter than that of the common plantain, having the shape and form of a bullock's heart. The fruits form clusters around the peduncle like the ordinary plantain, the berry is oblong and about the size of a duck's egg. Smooth and slightly ridged, three celled when ripe, nearly dry, having no pulp and filled with numerous black seeds, about the size of a small marble each. It is propagated from seed and suckers, the suckers are rare and occasional, and are not thrown up so plentifully as in the ordinary plantain. It is met with now about many gardens in Madras.

Musa rudra or *Red plantain*.—This is a tall plant, attaining some 20 feet in height, and producing a dark red colored and rather large sized fruit, averaging from 7 to 10 inches in length and of a uniform thickness; it is a very fine fruit with a rich flavor and buttery consistence. The plant is readily distinguishable from the dull red color that pervades every part. The fruit ripens of a yellowish red and is greatly appreciated; generally Europeans object to its strong flavor. It is grown about Madras and along the Eastern Coast, and is largely cultivated in the vicinity of Madras, more especially at the village of Voyalore for the Madras market, where it is always procurable. I have also seen it flourish at Combaconum in the Tanjore district. The fruit is generally eaten ripe and never cooked, as it is considered too valuable for such purposes, and is believed by the natives to possess cooling properties. The rind is thick and fleshy, and the pulp has a light straw color, peculiar flavor, and luscious taste, that is satiating.

Musa enset or *Abyssinian plantain*.—A single young plant of this pecies is growing in the Lall Bagh, Bangalore. It is said to be the largest of all plantains and the finest for decoration, and in general appearance it resembles the Musa superba, except that it does not become bulbous at the base, and attains a much greater height. This plant was pointed out to me at the Lall Bagh, Bangalore, by Mr. Cameron, the Superintendent.

Heliconia buccinata.—A small plant resembling the plantain and now common about Madras gardens as an ornamental plant. I have not seen it in flower.

Urania speciosa or *the Travellers' tree*—also known as the *Water tree*, is now found growing in many gardens about Madras, and it is particularly distinguished for the fan-shaped form the trees take from the spreading of their leaves and attaining the height of 20 to 30 feet. A tree in the Madras Horticultural Gardens is at present pushing out its flower spathe, and some trees in the Governor's Garden, Guindy, are in fruit, from whence I obtained the specimens. It is readily propagated from seeds, and I have the plant on the Shervaroy Hills. The fruit grows in clusters like the common plantain, 4 inches long and 2 wide, flat, and slightly convex in the upper, and concave in the lower side, the lower edge sharp, and the upper half an inch wide, and ridged at the edges. It is covered with a thickish rind containing a canine tooth-shaped hard shell, within which there is a deep blue cottony substance in which the seeds are embeded. The seeds are flat, concave-convex, having one end slightly turned in.

CHARCOAL.

BY ROBERT BAXTER, DALKEITH PARK.

THE manufacture of charcoal forms an important item in the annual routine of a forester's duties. I am not aware, however, if any attempt has ever been made to find out which kind of wood produces the best charcoal for cooking purposes. The usual way in making charcoal is simply to put the wood into the kiln or retort, just as it comes to hand, all sorts being mixed together. There is also considerable difference of opinion amongst foresters on this point; some holding that oak is the best, while others are equally certain that beech is preferable and so on. With the view of helping to solve this question, I lay before your readers the accompanying table, which has been compiled from the results of experiments conducted here, and which were especially entered upon to test the subject, and carried out with great care in every detail.

The two principal requisites in charcoal as a cooking agent are, first, the time it takes to boil a given quantity, of water; and, secondly, how long it will keep that water at the boiling-point.

All that is necessary in the carrying out of these experiments is to provide a small charcoal stove and a tin kettle. Being thus furnished, we begin by—

First.—Weighing out a quarter-pound of each kind of charcoal.

Second.—Measure off a pint of water into the kettle, then set it on the stove, and ignite the fire simultaneously.

Third.—Mark the time which elapses until the water reaches the boiling-point.

Fourth.—Note how long the water is kept boiling by the different kinds of charcoal.

Before starting the experiments, a fire must be lighted in the stove, and both it and the kettle thoroughly heated, so as to give each kind of charcoal an equal chance. When the experiments are proceeding, the fire can be lighted each time by a few bits of live charcoal from the preceding fire, being very careful to select them of equal size in each instance. When the water stops boiling, the stove must each time be cleared of all ashes. By such a process as I have described the figures given in the following table were obtained:—

Kinds of Wood from which the Charcoal was made.	Time taken to bring the water to the boilingpoint	Time during which the water was kept boiling.	Remarks.
Privet	14 minutes	50 minutes	Intense boiling.
Hazel	15 "	46 "	Moderate "
Thorn	15 "	46 "	" "
Bay Laurel ..	17 "	45 "	Intense "
Birch	11 "	44 "	Very intense "
Oak	22 "	42 "	Moderate "
Spanish Chestnut ..	16 "	41 "	Intense "
Boxwood.. ..	18 "	41 "	Moderate "
Ash	16 "	40 "	Moderate (charred in a retort).
Ash	23 "	36 "	Very moderate (charred in a kiln).
Cedar of Lebanon ..	22 "	40 "	Very moderate boiling.
Laburnum ..	27 "	40 "	Moderate "
Yew	20 "	38 "	" "
Sycamore ..	13 "	37 "	" "
Holly	18 "	37 "	" "
English Elm ..	18 "	34 "	" "
Beech	14 "	31 "	" "
Hornbeam ..	14 "	29 "	" "
Wych Elm ..	20 "	28 "	" "

The result obtained from Privet was so remarkable that we repeated the trial, which only proved the high heating power of charcoal made from it, the result of the second trial being identical with the first.

The charcoal produced in a retort was found to be superior to that made in an old-fashioned kiln, as will be observed from the result given in the table. The two samples of Ash which were selected for experiment were carefully tested to prove this point.—*Journal of Forestry*.

ROYAL BOTANICAL GARDEN, CALCUTTA.

THE Government of Bengal has passed the following Resolution on the Annual Report of the Garden for 1878-79:—

Notwithstanding the excessive drought of the cold season, which killed a number of young plants, it is satisfactory to find that the condition of the recently planted groups is fairly good. The improvements proposed in the previous year's report have been partly carried out, the new plant-houses have received considerable additions to the collection of plants grown therein, and continue to attract visitors. A broad straight road from the river entrance-ghât to the great banian tree on the west, the want of which was long felt, was commenced during the year under review. The low swampy ground in the vicinity of the banian tree, which has hitherto been one of the most unsightly parts of the garden, has been partly laid out, and it is hoped that, when the design has been fully carried out, it will present a greatly improved appearance. Changes have also been made in the roads towards the north of the garden, which have had the effect of opening to view a second banian tree of very large size. Many other minor improvements have been effected in various parts of the garden.

As ordered last year, the building in which the Herbarium and office are placed has been enlarged and improved by the Public Works Department, so as to afford sufficient space to prevent the overcrowding which has hitherto existed.

The experiments which have been going on for some years past in cultivating in the garden certain special plants, are again found to have been mostly unsuccessful. It is now decisively shown that the *Pará* rubber will not grow in Calcutta. It is therefore useless continuing the experiment any further. The *Ceará* rubber, however, promises to thrive, and Dr. King is in hopes of being able before long to supply seedlings for trial in various parts of the country.

Ipecacuanha cannot be grown to profit, though supplies of young plants continue to be issued. *Rhea* will not thrive as a crop, but two acres have been put under plant to supply fresh stems to intending competitors for the Government prize for a machine for clearing the fibre.

A large quantity of *Mahogany* seed was received from Jamaica, and was partly distributed and partly sown in the garden. The Forest Department have commenced mahogany cultivation in Chittagong, and many seedlings have been sent to the Assistant Conservator there.

The rain trees, of which a quantity of seed was received from the India Office three years ago, flowered during the year, and large quantities of seed and seedlings have been distributed. The sweet succulent pod of this tree is an excellent food for cattle, and it may become highly useful as a fodder-plant.

The *Carob* and the *Eucalypti* have been again found to be unsuited to the climate of Bengal. The plants of *Prosopis pallida* continue to thrive, but have not yet flowered.

The further experience gained during the year in the process of cropping clumps of *bamboos* in the way recommended by Mr. Routledge has confirmed Dr. King in the opinion previously formed, of the unsuitability of the plan originally proposed by Mr. Routledge. Mr. Routledge, however, is understood to have changed his plan, and to have recommended that instead of cutting down all the shoots of a bamboo clump, only a few shoots should be annually taken from each clump. Dr. King says that this is the principle on which bamboos have been cut in India from time immemorial, and that no experiments on its feasibility are required. The value of the fibre contained in the succulent shoots of bamboo as a material for the manufacture of paper, can only be tested by practical paper-makers. Even accepting Mr. Routledge's estimate of its value, the questions which Dr. King says should be settled are, whether commercial success can be obtained (1) by forming plantations of bamboos for the collection of succulent shoots; (2) by collecting the immature shoots of wild bamboos in the forests, and carrying them to a paper factory, or (3) by fitting up a floating paper-stock mill and moving it about on rivers by the banks of which bamboos naturally abound.

The *Baobab* cannot be grown in this country so as to be a source of paper fibre. The samples of wiry grasses off the Orissa coast which Dr. King sent to the India Office, have been unfavourably reported on by the paper-makers in London, to whom they were submitted for opinion. Dr. King does not seem to have yet examined the grass which grows on the banks of the Adjai and Damoodah, as was suggested to him in the Government Resolutions on his reports for the two previous years. As he is making further investigations on the subject, the Lieutenant-Governor will be glad to hear the result of his inquiry into the capability of the above grass to produce a paper-fibre.

The interchange of plants and seeds has gone on steadily. The thanks of Government due are to Sir Joseph Hooker, of the Royal Garden, Kew, to the Directors of the Gardens in Ceylon, Mauritius, and Australia, as well as to the Garden Collector, for the contributions received from them during the year.

The thanks of Government are also due to the gentlemen named in paragraph 11 of the Report for the large and valuable collections of dried plants presented by them to the Herbarium.

The branch Botanical Garden, which was established at Rungaroon some years ago has not been found a success, owing principally to its distance from Darjeeling; a garden has lately been opened at the station of Darjeeling, where a suitable piece of land has been presented for the purpose by Mr. W. Lloyd, an old and well-known resident of the place. This land is being cleared and laid out under the superintendence of Mr. Jaffary, late of the Cinchona Plantation.

The Lieutenant-Governor observes that it has not been the practice hitherto in these annual reports to state the expenditure incurred during the year in maintaining the gardens. In future years a statement should be appended showing the expenditure incurred in the Calcutta and in the Darjeeling Gardens separately; also the receipts, if any.

The Lieutenant-Governor thanks Dr. King and his staff for their useful labours during the year.

AGRI-HORTICULTURAL SOCIETY OF INDIA.

THE usual Monthly General Meeting was held on Thursday, the 21st of August 1879.

BABOO PEARY CHAND MITTRA, *in the Chair*.

The Proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members:—

Rajah Muttobar Sing, Messrs. C. F. Worsley, Thomas Anderson, C. H. Brookes, and E. D. M. Hooper.

The names of the following gentlemen were submitted for membership:—

The District Engineer, Mozufferpore,—proposed by the Secretary, seconded by Dr. S. Lynch.

F. D. Neish, Esq., Manager, Ramoo Tea Estate, Chittagong,—proposed by Mr. H. W. Barber, seconded by the Secretary.

Coomar Juggut Sing of Kashipore, N.-W. P.,—proposed by the Secretary, seconded by Baboo P. C. Mittra.

Arthur C. Showers, Esq., Noakacherra, Upper Assam,—proposed by Mr. St. G. A. Showers, seconded by the Secretary.

Dr. Vincent Richards, Goalundo,—proposed by the Secretary seconded by Mr. J. E. McLachlan.

Rejoined.—Maharajah Coomar Hurrendra Kishore Sing Bahadur, Bettiah, Tirhoot, and Rajah Ram Rutton Chuckerbutty, Hetampore.

CONTRIBUTIONS.

An assortment of seeds of forest trees from the Andamans,—from E. H. Man, Esq.

A small collection of seeds from the Acclimatisation Society of Queensland,—from L. A. Bernays, Esq., V.P.

The following is extract of letter from Mr. Bernays respecting these seeds:—

"Herewith I send you two packages of seeds, *viz.*, one containing *Eucephalastos miquelii* and *Banksia collina*, one of the most beautiful of this beautiful family, and *Avicennia officinalis*. This last is the white mangrove which you may have. If not, however, I may say of it that though a tree of littoral habit, it is capable of being handsomely grown away from the sea. The second package contains *Eucalyptus siderophloia*, and *E. Barleyana*. The first is the iron bark, the second a newly discovered species of last year, found on dry ridges."

A small packet of seed of *Zizania aquatica*, or wild rice of North America, described as splendid fodder grass for swamps in Upper India,—from Baron F. von Mueller.

A bag of Egyptian cotton seed,—from J. C. Chapman, Esq., of Alexandria. Available to members.

A small collection of seeds of useful trees from the Royal Botanic Garden, Calcutta,—from the Superintendent.

A collection of Orchids and Ferns from Sylhet,—from C. K. Hudson, Esq.

GARDEN.

The Head Gardener's monthly report was read as follows:—

"Weather seasonable, but rainfall rather deficient; work progressing favourably in all directions. Layers, gooties, grafts, nearly finished. Peaches yet remain to be inarched, but our paucity of malees causes the work to go on but slowly. Of contributions we have received seeds of palms, cycads, pandanus, &c., from Mr. E. H. Man, of Port Blair. The seeds from Queensland unfortunately died. Gloxinia, Begonia, &c., from Sutton and Sons duly sown. Valuable palm seeds from Mauritius Botanic Garden. Also a selection of various trees, including *Bischofia javanica* from the Royal Botanic Gardens, Howrah. The outlay in the gardens during the past month has been somewhat over the average, but is fully compensated for by the extra cleanly state of the garden; however I think we can reduce the establishment next month with safety. I herewith forward a flower of *Hibiscus rosea-sinensis colleris* for inspection. We have also received from Mr. Bull of Chelsea, two cases of plants, which includes a nice collection of Crotons, Dracaenas, Dieffenbachias, &c.; three plants only died out of a consignment of 120 plants. They were sent in Bull's Patent Cases, which seem to be very suitable when combined with careful packing. We have received a collection of Cryptograms and Orchids from Mr. Hudson of Sylhet. Further and similar donations of such would be useful for distribution and for specimens."

SINGHARA NUT.

In his letter advising despatch of the seeds above noted, Mr. Bernays, Vice-President of the Queensland Acclimatisation Society, alludes to the particulars given in the last published number of this Society's Journal regarding the Singhara nut. He writes as follows:—"I wish also to refer to Captain Pogson's notes on the Singhara nut, because we have succeeded well in growing the species of *Trapa* known as *T. bicornis*, but have met with a difficulty in harvesting the crop. It appears to us to be an annual plant, and seems to disappear, and the nuts to sink to the bottom before they are fit for gathering. There is, I think, an important future for the *Trapas* in Australia, and we therefore want all the information possible about them. Can you resolve my difficulty, and further say, if Captain Pogson proposes to sow his crops annually on the water, or expects them to re-appear from sunken nuts? We have not got the species known as *Trapa bispinosa*, but should much like to have it." The Secretary mentioned he had communicated with Captain Pogson on the subject.

PECULIARITIES IN CERTAIN VARIETIES OF THE PINEAPPLE.

In another part of his communication already referred to, Mr. Bernays alludes to a notice recently published by the Society, of a peculiar pineapple from Sylhet, in the following words :—

"I have to thank you much for Part I. of vol. VI. of your journal, which is full of interest for us. At page 46 I find notice of a peculiar pineapple from Mymensing. The enclosed extract may throw some light on this subject. It is taken from a letter written to us a few years since by Mr. Hugh Low, then of Labuan, now Government Resident at Perak, in the Malay Peninsula. The pineapples in question have with us only partially developed the peculiarity referred to, but our soil at Bowen Park is quite unsuited for them, while the moist heat of Borneo may also have some influence in giving this multiple character described."

Extract referred to in Mr. Bernays' letter of 16th June 1872 :—

"The multiple pine is a marvellous object. My attention was first directed to the search for it by the late Dr. Lindley, but I was many years looking for it in the Straits, when at last I found it in a Chinese garden. Instead of the usual shoots at the base of the fruit, it bears small pineapples of about six ounces in weight, each with its crown, and as there are a great many of them, and the main fruit is a large one of the sugar-loaf kind, it becomes a magnificent object on a large table."

APPLICATIONS FOR SEED OF PITHECOLOBIUM SAMAN.

The Secretary mentioned that he had recently had numerous applications from members and others from various parts of the country for seed of this cattle-fodder-yielding tree, the *Guango* of Jamaica, but had been able to met them only partially, in consequence of all the seed in his possession having been distributed. He had, however, applied to the Superintendent of the Royal Botanic Garden at Ceylon, for a further supply of seed of this useful tree, and hoped on receipt to meet all applications.

TOBACCO FROM COOCH BEHAR.

Read a letter from Messrs. Gillanders, Arbuthnot & Co., submitting for report and valuation some tobacco grown and cured in Cooch Behar, under the superintendence of an expert from Manilla, on which Messrs. Anderson, Wright & Co. had kindly made the following remarks ;—

"We are in receipt of your favour of date, and have carefully inspected the musters of tobacco. These seem well cured and show a fine rich leaf, but as we have so often had to point out when referring to such musters, there is no market for this style of leaf. If the expert who has prepared the tobacco can transform the leaf into cigars that can be smoked, he will find a large consumption for them, but no one wants Indian leaf tobacco of this stamp. English manufacturers will not take a present of it, as it won't carry enough of water, and continental buyers are just as well pleased with ordinary native *poola*."

Letters were submitted—

From E. Buck, Esq., requesting, on behalf of a correspondent, particulars in respect to the cultivation of the pineapple in Philibeet (Complied with).

From the Superintendent of the Benares Jail, a sketch of the "Benares Jail Plough," with directions for its use.

From the Secretary, Department of Agriculture, Melbourne, returning thanks for a copy of the last published number of the Journal, vol. VI., part 1.

From the Agent, E. I. Railway, regrets he is unable to sanction the free carriage of trees, &c., required to line public roads at various stations on the line of Railway.

INDIAN WHEAT.

Referring to the blue-book recently published, containing a full report by Dr. Forbes Watson on Indian Wheat, the Secretary drew the attention of the meeting to the steps taken by this Society, many years ago (1843), regarding this important staple, as shown in the voluminous correspondence and papers connected with the cultivation and production of wheat in India as published in its journal, vol. III., old series. Also to the petitions subsequently presented to both Houses of Parliament on the justice and expediency of allowing the admission, into the ports of Great Britain, of wheat from this country, on the same terms as had then been conceded to wheat from Canada. The wheat of the Punjab was not then taken into consideration, but it was shown what fine varieties were raised in certain parts of India—especially the Central Provinces,—and that the establishment of an export trade from India in corn was even then pregnant with advantages to the country, notwithstanding the difficulties which then existed, but m[illegible]t of which have since been removed by the formation of railroads and m[illegible]ore rapid steam communication with Europe.

DEVELOPMENT OF THE WILD SILK INDUSTRY OF INDIA.

The subject which next came under consideration had reference to the wild silk industry of India, as embodied in the supplement to the *Gazette* of India of 2nd August. The Secretary called to the notice of the meeting the fact that, as in the case of wheat, the improvement of the wild silks of India—Tussur, Eria, Moongah, and others,—had engaged the attention of this Society at various times for the past forty years, as a reference to its transactions and journal would show. So long since as 1839 the Society offered a reward for promoting the cultivation of the Eria worm and the reeling of its silk. Nearly every volume from that time, till recently, contains notices on the wild silk worms of India, including several able papers by the late Captain Thomas Hutton of Mussoorie. The trials now making by Mr. Wardle and others in the same direction are very encouraging towards the development of an industry which will probably ere long become on[illegible] of great importance.

The Secretary placed on the table several flowers of double Balsam of many colors, some very brilliant, raised in his garden from the imported [illegible] distributed to members at the commence-

RAMEH FIBRE.

THE Samarang *Courant* of the 22nd July states that Messrs. Van Maanen and Moorrees, of Salatiga (Java), had addressed a circular to the commercial associations at the three chief towns of Java announcing their failure, after years of experimenting at heavy expense, to prepare rameh in the manner desired by the British Indian Government when promising a reward of 50,000 guilders for a method of separating from damp rameh, the fibres in a clean and white condition, and free from gummy and woody constituent parts. The result is thus described :—

"Notwithstanding every effort, they could not fully attain the object in view. They could indeed approach it by stamping and beating for a long time the fibre separated by machinery, but with an eye to the market price, too much hand labour was required. To effect this portion of the preparation by machinery, a fresh series of experiments would be necessary which the state of their finances did not admit of. Even chemically they could not succeed in removing from the bark the viscid matter which soon becomes hard, without doing damage to the strength of the fibre."

On the other hand, their experiments have shown that the separation of fibre from dried rameh is easier and more profitable than that from the green rameh plant. The only objections to the dry method are that the resulting fibres are not completely white, and that artificial drying would be required during the greater portion of the year, but European manufacturers do not consider the former of much consequence, and the cost of the latter is trifling because the woody portions of the rameh could be used as fuel. Their own funds being inadequate, Messrs. Van Maanen and Moorrees invite the aid of the mercantile community to enable them to alter their rameh mills for the dry method of preparation. Accompanying the circular are samples of rameh so prepared. These showed conclusively that the dry method is the only one by which a practical result could be obtained.

THE Old Cork Oak at Fulham Palace is believed to be one of the oldest, as it undoubtedly is one of the finest, cork oak trees in the country. The *Gardner's Chronicle* in giving an excellent illustration of this unique old tree, thus describes it :—"The tree has passed its prime, having been planted at Fulham, probably by Bishop Compton, more than 200 years since. At breast height the tree girths about ten feet. It is a fine specimen, but needs the support of ivyclad props. From the acorns numerous seedlings have been raised. The cork oak (*Q. suber*) is a native of Southern Europe and Northern Africa. When the tree is about fifteen years old, its bark is removed by incisions in such a manner that no injury is done to the tree. After eight or nine years the process can be repeated. The outermost layers form the 'male cork,' which is of little value, except in the form of 'virgin cork'. After their removal new corky layers are formed in the denuded bark, which constitute the female cork, or cork of commerce. The tree at Fulham stands in the angle between the palace and the newly erected chapel, on the walls of which latter ivies of various kinds are placed, some of which have made extraordinary growth, especially the silver ivy."—*Journal of Forestry.*

THE Surveyor-General of Natal reports that a tree of *Eucalyptus globulus*, twenty-five years old, was recently cut down in that colony (the species was introduced into the South African colonies many years ago) which yielded 700 cubic feet of timber, and realized nearly £20 for fuel. He adds that clumps of Eucalyptus planted in undrained swamp lands, at various elevations up to 4,000 feet, have been found to completely dry the space within reach of their roots. The growth of timber in these situations is computed at twelve tons per acre per annum, while the annual growth of the vegetation which it superseded did not exceed 1½ ton per acre.—*Gardener's Magazine.*

THE Secretary of State has had his attention directed to the peculiar properties of the *Brosimum galactodendron* or "Cow tree" of Venezuela, which it is thought may be introduced with advantage into India. A supply of the seed of the tree has been obtained from South America and forwarded to India for experimental purposes.

COLONEL R. A. MOORE, Acting Commissary-General, reports to Government that on receipt of instructions to cultivate *Sorghum saccharatum* at Hoonsur, an estimate was drawn up for clearing a piece of land and purchasing the necessary implements ; but this estimate was not sanctioned by Government, and an alternative scheme which had been suggested of growing the sorghum at the experimental farm at Bangalore, under the superintendence of Mr. Cameron, was adopted instead. Soon after this it was determined to break up the experimental farm at Bangalore, and the Chief Commissioner of Mysore intimated that in consequence the experimental cultivation of *Sorghum saccharatum* could not be carried on at Bangalore. Colonel A. Drury, Agent for Remounts, reports that no further experiments in the cultivation of sorgho, has been tried at Oossoor. He adds :—"I am, however, convinced that it will not succeed except in the rainy season, or with irrigation, and that the land under irrigation in the depôt farm can be turned to more profit in cultivating Lucerne and other grasses, such as Guinea grass and rhea grass. I have lately been trying an experiment with some seed of the *Rhea luxurians*, which I obtained from Calcutta, and am inclined to think it will give a better return of green forage than the sorgho in the dry season, as it does not require the same amount of irrigation."

An American paper says:—Quite a heavy business is done in California in shipping to China the shells of the shrimps, which are caught in such numbers on the coast, and there is almost as much profit from the sale of the shells as from the shrimps themselves. The use they are put to in China is as a manure, and as a poison to the worm which works such destruction to the tea-plant of that country. The Chinamen state that this is the only remedy at present known for the tea-pest..

A NEW use for whisky! Planters should note that correspondents of the *Gardener's Chronicle* have been acknowledging the utility of whisky as an insecticide. One of them, whose grape-vines had been attacked by mealy-bug, says, "Being unwilling to spoil the grapes by using any of the insecticides warranted to kill bug, it occurred to me that a dose of strong Scotch whisky might have the desired effect without injuring the grapes further than spoiling the bloom; and I am glad to say that I found it most effectual, worked in among the berries with a brush made of a few feathers. It kills the vermin at once." The two objections to the use of Scotch whisky will occur to our readers at once,—the expense, and the great danger of the liquor finding its way down the throats of those entrusted with its application to the trees.

FROM a recent report of the Madras Agri-Horticultural Society, we see that the acclimatisation of the Persian date palm continues to engage attention, and information on this question is anxiously awaited. Utilising the cactus as a protector of saplings, has formed the subject of some letters between the Deputy Conservator of Forests and Mr. Thomas, the Acting Second Member of the Board of Revenue; the opinion of the former official being adverse to the proposal of sowing seeds of quick-growing fire-wood and timber trees amongst cactus enclosures. Mango and *Illupu* seed he believes will prove a failure under the experiment, but recommends thickets of *valum* as more promising. The dwarf variety of wild date is, he further thinks, a valuable aid to tree conservancy, and he has, under this conviction, generally scattered seeds among them, when they happened to be close to villages, and when the formation of village firewood tracks was necessary. The success of the experiment, the Deputy Conservator tells us, was a strong argument in favour of Mr. Thomas' plan. The Horticulture Society's Committee seem to be alive to the value of the common *acacia* in its gum and bark capabilities: the seed pods of the tree are not overlooked as an auxiliary food to sheep and goats.

WE are glad to hear that the Carob tree (*Ceratonia Siliqua*) in which the Forest Conservator of the Punjab takes so deep an interest, is thriving in the Ajmere district. Brackish water should not be applied to it.—*Delhi Gazette.*

THE Secretary of State has had his attention directed to the peculiar properties of the "Brosimum Galactodendron" or "Cow Tree" of Venezuela which it is thought may be introduced with advantage into India. A supply of the seed of the tree has been obtained from South America and forwarded to India for experimental purposes.—*Ibid.*

THE wheat grain is a fruit consisting of a seed and its coverings. All the middle part of the grain is occupied by large, thin cells, full of a powdery substance, which contains nearly all the starch of the wheat. Outside the central starchy mass is a single row of squarish cells, filled with a yellowish material, very rich in nitrogenous, that is, flesh-forming matter. Beyond this again there are six thin coats or coverings, containing much mineral matter, both of potash and phosphates. The outermost coat is of but little value. The mill products of these coverings of the seed are peculiarly rich in nutriment, and fine flour is robbed of a large percentage of valuable and nutritious food. Middlings not only contain more fibrin and mineral matter than fine flour, but also more fat. The fibrous matter, or outer coat, which is indigestible, forms one-sixth of the bran, but not one-hundredth of the fine flour. Wheat contains the greatest quantity of gluten and the smallest of starch; rye, a medium proportion of both, while in barley, oats, and corn the largest proportion of starch and the smallest of gluten are to be found. In practice 100 pounds of flour will make from 133 to 137 pounds of bread, a good average being 136 pounds; hence a barrel of 196 pounds should yield 266 one-pound leaves.

THE Canadian Government is inaugurating a new policy in regard to the Indians of the North-West. Fourteen schools of farming are to be established there for the purpose of instructing the Red Man in agricultural pursuits, and duly qualified persons are already appointed to carry out the scheme. Whatever the nomadic Cree, Sioux, and Blackfeet may prove to be as tillers of the soil, it is certain that they are admirably qualified to ten' and raise stock, and the rapid disappearance of the buffalo makes an attempt of the kind desirable if not imperative.

AN inquest was held by the Liverpool Coroner last week on the body of a joiner, named John M'George, aged 69. The evidence was to the effect that the deceased had all his life been a healthy and temperate man, and that on Sunday night he went to bed as usual after his tea, at which he had taken a little London lettuce. On Monday morning he appeared to be suffering from a severe bilious attack, and looked very drowsy; at 9 o'clock he appeared to be in a fit, and he died the same afternoon. A *post mortem* examination pointed to the conclusion that death was primarily the result of apoplexy, which was induced by the quantity of opium contained in the lettuce, and which would be dangerous to an elderly person. The jury found that death had resulted from poison, but whether or not it was contained in the lettuce there was not suffi cient evidence to show.

OF the Colorado beetle it might perhaps be said that, like another aërial potentate, its acts have not proved quite so bad as its reputation. At all events, it has not exterminated the potato plant in America, as the farmers feared; and it has been kept under without the use of the effective, if circuitous method of squeezing between deal boards, recommended by the ingenious Canadian. The insects now ravaging the grain crops in Eastern Europe have been ascertained to belong to the Cleonidæ, a family of the weevils, one species of which is so destructive to corn in granaries. They, however, are more mischievous in the grub stage than in their perfect state, although some of them feed upon cereal products in both. Those in question, if mature, are probably not easily poisoned by Paris green, and too numerous and too minute to be reached by the other appliances which have proved so successful in the case of their American congener. The swarms are immensely large, and the people of the province of Odessa believe that they are incessantly thrown up by the sea, and then rapidly spread themselves over the fields, devouring everything before them. That of course, is nonsense; but they may be blown into the sea on their way from the valley of the Danube, or some other place whence they have been driven, perhaps, by the long-continued rains. Wherever they hail from they seem to be spreading, doubtless by the arrival of fresh detachments, for beetles, unlike aphides, undergo a regular series of transformations.

GARDEN.

FRUIT IN CALIFORNIA.

IT makes one's mouth water to read the following:—'We are in receipt of two more cargoes of oranges from Tahiti, per *Greyhound* and *Caroline Medan*. Here we have 480,000 oranges thrown upon a market already glutted with the same fruit of home product, and selling, if at all, at very low figures. Apples (Red Astrachan and other early kinds), are now very plentiful and cheap, the same being taken freely by jelly-makers and bakers. Peaches of good quality are becoming quite plentiful. Our market seems to be flooded with the choicest of fruits and vegetables. Apricots are very plentiful and cheap, and canners have now commenced upon them.

Cherries are very abundant, choice varieties selling cheaper than ever before, enabling our local canners to put up a very much larger quantity than heretofore, at the prospect of having a large surplus of this fruit for the English market. Berries are quite plentiful, save strawberries, the second crop of which does not come up to expectations. Raspberries are plentiful and cheap. Blackberries promise a full crop yield. Currants are in good present supply, but the crop is said to be a light one, pears, plum, green corns, gooseberries, cucumbers, tomatoes, &c., can now be had in quantities.

The grape crop is exceedingly promising, and we will soon have a plentiful supply. Potatoes of choice new crop are a drug upon the market, and the best of them do not pay for marketing. Green peas, asparagus, string beans, summer squash, okra, &c., are now abundant and cheap. Lemons and limes are in fair supply. In fact there seems to be a great abundance of everything this year, and this will, perhaps, in a measure account for the general good health everywhere prevailing throughout the State.'—*San Francisco Market Review.*

NATURAL HISTORY NOTES FROM BURMAH.

The Dorian.—The Dorian is a large capsular fruit with four or five loculaments, each containing one seed which is covered with a layer of pulp, the part eaten. The rind, as well as the seeds, emits a strong odour of sulphide of methyl.

Dorian eaters say that the excellency of the fruit consists in the succession of exquisite flavours experienced in eating it. From my own experiments I believe this to be due to a reaction of the nerves of taste, analogous to that of the retina, which causes the images of objects to appear in their complementary colours when the eye is suddenly shut.

R. ROMANIS.

Government High School, Rangoon, *Nature.*

FORESTRY.

We have received several reports of forest operation for the year 1877-78, from which some profitable information may be gleaned. That for the North-Western Provinces and Oudh tells us that the area of reserved forests is now 3,478 square miles. In the district of Dehra Doon there is an area enclosed amounting to 563 square miles, of which 449 are on the sub-range of the Sewalick Hills. The entire district is only 677* square miles in extent, consequently 83 per cent. is under forest control. This is a very heavy proportion, and its effect has been to throw a large part of the unreserved land into the hands of monied natives, who will only sell at fabulous prices. A large part of this reserved land is suitable for tea, and it is a pity that this industry should be checked in a locality where labour is so plentiful and cheap. Twelve years ago purchases of tea land were made at Rs. 5-4 per acre, and some of the tea companies now value their spare land at Rs. 130 per acre.

In the Central Provinces the reserve amounts to 2,548 square miles. In all these reports, as in those of the experimental and model farms, great stress is laid on the principle of their paying. This should be entirely a secondary consideration. The object as we take it, of these reserved forests, and of the existence at all of the Forest Department is to preserve such forests as we have, and to increase them if possible, and it does not follow that such a scheme should pay now, it is expected to pay in an indirect manner in after years, and we are just afraid that the efforts made by Conservators to please Government by presenting a favorable annual balance sheet, may be prejudicing the future good sought to be derived from the labours of the department.

The report of the work in the Hyderabad Assigned Districts tells us that the reserved forest area is 1,402 square miles. Sundry experiments have been tried with new trees, the department having been successful with the *Eucalyptus rostrata.* The carob and several species of the pine were also tried. The former was a failure, and the latter are apparently too young to report on, we should think that the climate of those districts was too hot for the pine which flourishes best in colder regions.

The area of reserve in Mysore is 442 square miles. The unreserved forest has not been surveyed, and no approximate guess is made at its extent. Considerable attention is being bestowed on the protection of these reserved forests from accidental or incendiary fire, which seems to be a much needed precaution. The nett profits on the year's working seem to have amounted to Rs. 2,04,575, and the bulk of sales were of sandalwood.

The Coorg Report is smaller than the others, and is all the better for that, we imagine too much time and money are expended on these reports, which are, some of them, of great bulk, that of the N.-W. P., extending to 145 pages foolscap. Doubtless they are useful in disseminating useful information, but all this might be done much more economically and in fewer words. The area of reserve is 295 square miles, that of unreserved being as yet unmeasured. The Conservator reports with apparent pleasure, the demand which exists for timber, we should have thought that there was always a pretty fair demand, and that the deficiency existed more in the supply. The income for all sources was Rs. 1,01,015, and the amount expended Rs. 36,267, which sum does not include the Conservator's salary or travelling allowance. Out of this all that was expended on new plantations was the insignificant sum of Rs. 1,659.

The Ajmere Forest Report does not point to much good being done. The reserved area is 100 square miles, the income Rs. 3,002, and the expenditure Rs. 14,926, more than half of which latter sum is made up of salaries and allowances. Under three thousand rupees were spent on plantations, and we really do not see much that was done, save selling grass and firewood, fining trespassers, and granting *purwanas* for grazing.

A careful perusal of these forest reports, leads to the conviction that more time and labor are spent in endeavours to make the department pay *now*, than are with the view of the country benefiting ultimately by the care which should be bestowed on growing timber, and the attention which ought to be given to the important work of extending the forests in all directions. This latter is neglected simply because it would entail expense and bring no income for sometime.

The grazing of cattle is a mistake. The Ajmere Report tells us that the sum of Rs. 61-1 was realized from this source, but who can tell us of the amount of damage these animals did to the young plantations.

* Census Report of 1865.

The Deodar forest of Koti in the Jaunsar division is an interesting feature in the Forest Report of the North-Western Provinces. This tree the *cupressus torulosa*, is one of the handsomest trees in India, besides providing timber of great value; the wood is useful for making doors and windows, as it is more easily worked than sâl, and is as safe from the attacks of insects, from the large quantity of turpentine in it. This forest extends to about 89 acres, and is almost covered with first class timber. In other portions, as the Deota range, there are Deodar forests extending to 40 square miles, but the trees there are of various ages.

In addition to the several district reports, the Government of India have issued a general review of the work done by the department, for which we cull a few particulars. The reserved forest amounts to 18,113 square miles, as against 17,835 in the previous year, but we have no information as to the extent of the unreserved forests, consequently we do not know the total extent of forest in the country. This is doubtless being ascertained by means of forest surveys. The financial results, which are considered as "not unfavorable" show a total expenditure of Rs. 32,00,175, while the revenue is Rs. 55,76,141, profit Rs. 23,75,966. As we have repeatedly said the financial results of these schemes should always be considered as quite of secondary importance. The objects of the department are not commercial, and if the operation carried on for the improvement of forest conservancy result in a profit, so much the better, but this profit should not be looked for nor insisted on.

SEED-TIME.

The Law of Continuity in Nature is *endless reproduction.* An acorn falls to the ground, germinates, and an oak is the result. The tree withers and decays, but not before other acorns are deposited, ultimately to grow into trees. There is thus continual change, but never annihilation. Nature strictly preserves the law of continuity. She must have everything in season. In the law of continuity, Nature indicates seed-time and harvest. Man, it is true, may entertain notions on the subject of seed-time expedient enough, but none the less erroneous. Nature's law of continuity is infallible, and the cultivator ought always to be guided by this rule, when he will find that the correct time for sowing is just when Nature has perfected the seed and prepared it for the soil.

Ballinacourte. D. SYM SCOTT.

In the Journal of Forestry.

A MONSTER LOG.

Recent issue of the *Mississippi Lumberman* says:—On Saturday last a log was cut at Hitchcock and Ingram's new mill by the upright that was without a doubt about as large as they make. It scaled 1,800 feet, and was measured by Mr. Hitchcock across the end and found to be five feet and nine inches, and twelve feet long. It came with a raft of logs for John McGraw & Co., but it seems that when they got this one in their big mill, they had a bigger thing in the shape of a saw log than they could handle, and they ran it back into the river, where it finally found its way to Hitchcock and Ingram's mill, and after considerable work was got inside, and finally converted into four inch plank, four of which were three feet and eight inches wide and twelve feet long, without a knot or flaw in them.

A BURIED FOREST.

An interesting geological discovery has been lately announced, which was made by Dr. Moesta, the Geological Director of Marburg, in the course of some extensive explorations in the neighbourhood of Rotenburg on the Fulda, in Hesse Cassel. From his investigations Dr. Moesta has come to the conclusion that an oak wood lies buried in that portion of the valley of the Fulda, at about a depth of from six to nine feet below the surface. This wood flourished at a very remote period of the earth's existence. Explorations carried on in the bed of the Fulda have brought to light several of the trees. It is estimated that between 200 and 300 trees are embedded in the river-bed between Hersfeld and Melsungen (about 30 miles), which would warrant the expectation that at least ten times that number are to be found in the soil of the adjoining valley. The greater number of the trees discovered were in good preservation; but owing to the action of the water through unnumbered ages they have become thoroughly black in colour. They have also become very hard and close, so that they would be excellent material for carving and ornamental cabinet-work. Some of the trees are of great size; one taken out of a gravelly portion of the bed opposite the village of Baumbach, and since sent to the Geological Museum at Berlin was 59ft. long, nearly 5ft. in diameter near the root, and about 38in. at the top, so that its solid contents are about 630 cubic feet. Even larger specimens have been found. It is reported that the furniture and fittings of the Geological Museum at Marburg are

to be made from this long-buried timber. An interesting question remains to be solved; do those buried oaks belong to a species still existing, or to an extinct one?—*Journal of Forestry.*

THE FORESTS OF FINLAND.

CONSUL CAMPBELL states that the produce of the forests in Finland supplies more than one-half of the total export of the country, it is therefore apparent of what infinite importance the proper husbanding of them must be to the welfare of the Grand Duchy. It is estimated that 61 per cent. of the total superficial area of the country or, in other words, 213,722 square kiloms., are covered with timber; unfortunately, however, these enormous resources have much deteriorated during the last fifty years. The system of setting fire to the trees, in order to clear the ground, is still practised in many districts of the country on a large scale, and the conflagrations thus originating sometimes assume great proportions; new laws and regulations, however, lately put in force, have contributed in some measure to modify the evil. Another cause of ruin to the forests is the system of burning the pine trees to obtain tar, and the third cause is the annual destruction of millions of young trees hewn down for the purpose of making palisades round the buildings and fields.

According to the report of a commission lately appointed to make an approximate calculation of the Government forests, it appears that no less than 754,000,000 cubic feet of wood are actually absorbed in Finland annually, without taking into account the quantity consumed in the town, nor that exported from the country. It must, however, be admitted that this state of things has somewhat improved since the means of communication have progressed, and the value of timber advanced to a price which it never previously commanded; this last-mentioned circumstance has, however, unfortunately, been the means of inducing the forest owners, tempted by the high prices, to dispose of their property to the saw-mill proprietors, whose interest naturally lies in taking out of the forests as much as possible, without respect to the age or size of the trees. This question is at present engaging public attention as well as that of the Government, and, doubtless, if it is not discontinued, measures will be adopted to put a stop to this wholesale destruction of timber.

The researches lately instituted to ascertain the time necessary for development of trees in various parts of the country show the following results. In the south of Finland, 61·30 latitude, the pine forests in good soil yield building timber in 60 years; on middling soil, in 80 years, and on indifferent soil, in 100 years. To be suitable for sawing purposes, the pine tree requires to attain the age of 100 to 110 years. In the middle districts of Finland the growth of timber is twenty years longer under like circumstances. Lastly, in the northern districts the pine trees require from 120 to 180 years to develop themselves so far as to be serviceable for building timber, and 180 to 230 years before they can be used for sawing purposes.

Notwithstanding the enormous abuse of timber previously alluded to, Finland is a country still rich in forests, for which she has to thank, in the first instance, a most propitious climate, and a sun particularly favourable to the growth of timber; and, in the second, to the fact that more than one-half of the surface of the forests is the property, and under the control of the Crown. In fact, the Crown forests, after deducting the territory occupied by lakes and morasses, cover a superficial area of 131,500 square kilometres, the greater part of which lies in the northern districts of the country. The administration of the forests is entrusted to a directorate, whose seat is in Helsingfors, and who has under its control eleven forest chiefs, and a great number of under-officials. It is not many years since the cutting of timber was accomplished by the peasants, during the winter months, by means of the hand-saw, and now we find large saw mills, driven by both steam and water power, at the estuaries of all the great rivers, and at the various waterfalls throughout the country. At present, the saw-mill proprietors prefer purchasing their stock from private parties rather than from Government; but, doubtless, this will soon change, since the Crown has determined to spend a large amount of money in clearing the water courses around their forests, and in every way improving the means of transit and floating.—*Society of Arts Journal.*

MINERALOGY.

DURING the year certain investigations were made in British Burmah into the subject of coal, which has repeatedly been found in the country, but never of sufficiently good quality to warrant the mineral being worked, again some has been found by a party searching for petroleum, the quality is fair as it has been tested on the railway, but the situation precludes the working of it profitably.

THE petroleum trade is slowly moving on, and very little more will or can be done till the price of the American article rises. This latter is now so cheap that it is actually more profitable to import it than to work the native article.

LIMESTONE of considerable value has been found in several districts as Kyouk-Phyoo, Bassein, Thayetmyo, and Amherst. An attempt has been made to work the tin mines of Malewoon, but the results have not been such as are likely to encourage further operations.

IRON is said to be found in four taluks of the Bangalore district, five taluks of Kolar, and one of Toomkoor district. Iron also abounds in eight taluks of Nagar division, as well as in the Mysore district of the Ashtagram division. The number of the mines is officially recorded as over 200, and furnaces for the manufacture of the metal as over 1,300, and the average annual yield as over 35,000 maunds. Two seers of gold are reported to have been obtained in one year in the Betmangala taluk of the Kolar district, here the alluvial soil is washed for finding the article. Gold dust is also occasionally found in the washings caused by the monsoon rains from the Hemagiri hills in the Hulyurdurga taluk of the Nundidroog. The washers used to realize about 4 annas per day.—*Bangalore Spectator.*

OUR Punjab contemporary says that another attempt to establish an iron industry is to be made in Sirmoor. The preliminary accounts of the concern are most flourishing. It is announced that the magnetic ore may be found in large quantities within a very limited area. Specimens of it sent to England for analysis have been pronounced equal in quality to the best Swedish iron. So the English Superintendent of the Sirmoor Works expects to manufacture about fifty tons a week. And we are told that Government will be ready to buy quantities of the new article even at prices above those which rule in the regular market. It is not the first time that ironworks have been started in the Punjab and failed. Considering, too, the immense quantity of fuel that will be required at the works, it is difficult to see how the enterprise can be conducted on its proposed scale for many years, except at the cost of disafforesting the entire State of Sirmoor.

FACTS ABOUT COAL.

MR. MAURY, in a late number of the *Popular Science Monthly*, in an article entitled "Black Diamonds," presents some interesting facts on the subject of coals. He says:—The population of the United States is about 40,000,000, and in 1877 50,000,000 tons of coal were produced, one-fourth of which, if applied to manufacturing, &c., would do as much work as our entire population, supposing them all to be able-bodied men, in three hundred and fifty days. He adds: The coal at the engine will average about four dollars a ton, while the price of unskilled manual labour can be put down at one dollar a day. Applying these figures, we see that the work in the first case would have cost 50,000,000 dols.; while in the latter, were it even possible to employ so many men, the labour bill would have been 14,000,000,000 dols.! Mr. Maury states that the first discovery of coal in America was in Illinois. In 1877 over 21,000,000 tons of anthracite coal were produced. The first Lehigh anthracite sent to Philadelphia in 1803 was considered worthless, and broken up and used for macadamizing purposes. Coal is of vegetable origin. Wherever vegetable tissue is heaped up and accumulated in bogs, coal can be seen in various stages of formation. Wherever the woody matter is surrounded by moisture and in favourable position for slow decomposition, it is transformed into a dark combustible compound called "peat," and as it grows harder and more changed it is called "lignite." The oldest peat bogs in Europe have, at or near the bottom, thin layers of hard, black matter that neither examination by the eye nor analysis by the chemist can distinguish from true coal, and which, therefore, must be true coal. Mr. Maury also gives the following table, showing the area of coal fields in square miles in different countries:—

Countries	Areas of coal field in square miles.	Percentage of total area.
United States	192,000	73 85
Nova Scotia	18,000	6·90
Great Britain	11,900	4 60
Spain	3,000	1·20
France	1,800	0·70
Prussia	1,800	0 70
Austria	1 700	0·70
Belgium	900	35
Chili, Australia, India, China, &c.	28,000	11·00

Arrangements are being made to heat the City of New York and do the cooking for the inhabitants by steam, furnished through pipes from central distributing points in different parts of the city. The plan is the same as that in use in the city of Lockport, N.Y., which is giving entire satisfaction, and reduces cost of warming houses and cooking food very materially.

REPORT ON THE ALPHA GOLD MINE IN SOUTH-EAST WYNAAD.

Dated Devalah, the 18th February 1879.

From—R. BROUGH SMYTH, Esq., Mining Engineer.

To—J. H. GARSTIN, Esq., Acting Secretary to Government of Madras, Revenue Department.

REFERRING to the paper, dated 10th January 1879, No. 42, wherein I am instructed by the Government to ascertain how it is that, notwithstanding the presence of considerable quantities of gold in the reefs at the Alpha Mine and to the extent reported by me, the operations have not proved successful, and especially whether this want of success has arisen from any peculiar difficulties in separating the gold from the matrix at this particular spot, or from the cost of labor or fuel or from other reasons within or beyond the control of the mine proprietors, I now do myself the honor to submit the following report for the consideration of his Grace the Governor in Council.

PRELIMINARY.

Immediately on receipt of the instructions above referred to, and as directed by the Government, I communicated with the Directors of the Alpha Company and sought permission to make a careful examination of the mine, and at the same time I asked a number of questions respecting the operations of the Company.

Subsequently I wrote to the Secretaries and Treasurers in Madras requesting them to furnish such information respecting the work done in the past as they could supply.

The Directors very promptly furnished papers relating to the expenditure of moneys, the quantities of quartz raised and the results, and they replied to some of the questions asked by me; and I would wish to record my appreciation of the assistance afforded by them, by Messrs. Parry & Co., and by Mr. G. E. Withers who at one time had the management of the works under what is known as "The Prince of Wales Quartz Reef Gold Prospecting Company," a Company which held and worked the Alpha Mine on tribute for a brief period.

Though necessarily from the nature of the duties which I have had to discharge since I came to this district, I was well acquainted with the mine and the machinery of the Alpha Company, I have since the receipt of instructions made a further careful examination of the land held by them, the reefs, and the works erected for the purpose of reducing the auriferous quartz.

THE AREA GRANTED TO THE ALPHA COMPANY.

I have not been able to obtain a plan or a sufficient description of the boundaries of the area granted to the Alpha Company. The extent is said to be fifteen acres, but on the map of the Ouchterlony Valley, and three Amshoms of South-East Wynaad the area marked "Alpha Company" exceeds one hundred acres.

The lines of demarcation as pointed out to me on the ground seem to embrace a larger area than fifteen acres.

The boundaries are thus described in the prospectus of the Company:—A block of fifteen acres bounded on the west and south by two large streams, and on the east and north by four demarcation stones.

As my report deals principally with only so much of the main reef as is known to be within the area granted to the Company, the question of boundaries need not be further referred to.

THE QUARTZ VEINS.

The principal quartz vein intersecting the land is that known as the "Skull Reef." It appears at the surface at various points between "Wright's Level" and the northern boundary of the Company's area, and is traceable further northward for a great distance. Wright's Level is on the eastern slope of the range that forms the western rim of the basin drained by the Carcoor Poya, and is distant thirty chains from the Alpha mill.

The country is intersected by streams trending to the Carcoor Poya, and there are low and high hill, some very steep, but nearly all with smooth contours.

At Wright's Level the vein is from four to five feet in thickness near the surface, and seven feet six inches at a depth of thirty feet. Its strike for a distance of more than one chain is nearly north and south, and the dip is east at an angle of 30° to 40°.

The quartz in some parts of the vein is laminated, the laminæ being from two to four inches and more in thickness, and they are nearly parallel to the line of strike. These are crossed by other lines transverse to the dip and strike, and there are in places thin veins of talcose clay cutting the reef transversely. There is also solid iron-free nearly white quartz. Near the surface the stone, when broken out, is seen to be highly ferruginous and is colored yellow, bright red, and bluish purple. Much of the quartz is cavernous, honey-combed, or mice-eaten, and the associated minerals near the upper part of the vein are limonite and other oxyds of iron due to the decomposition of iron pyrites which are found in considerable quantities in the deeper levels. Sulphur is also seen occasionally in cavities. I have not seen any sulphide of antimony or any of the ores of lead.

Northward, twelve chains from Wright's Level, an adit made by native miners has been re-opened by me, and the thickness of the reef at this point is four feet; the strike is nearly north and south, and the dip is nearly due east at an angle at the outcrop of 45° and at a depth of twenty-four feet 60° nearly.

A section taken from the middle of this reef shows massive white nearly iron-free quartz. It is ferruginous and cavernous near the hanging wall and foot-wall.

At the large excavation from which the reef derives it name about twenty-two chains north of Wright's Level, the vein is thick; at the face it is not less than fourteen feet from the hanging wall to what appears to be a "horse," the extent of which has not been ascertained. The total thickness of the reef at this point is not known. The general character of the stone is similar to that at Wright's Level, but there it much more sulphur. It is not difficult to find rather large quantities of clean sulphur in the cavities. Here also there is an absence of those minerals that are most detrimental to amalgamation. The strike of the reef is N. 20° W., and the deep N. 70° E. at an angle of 18° to 30°, but the dip nowhere is uniform.

About four chains and fifty-six links north-westerly from the excavation the reef is again seen on the bandy-road where it intersects a low hill. Here the dip is N. 80° E. at an angle of 40°, and the thickness as well as can be observed is six feet. On the north-western side of the hill the outcrop is again found, and it is seen also on the further side of a stream which runs at the foot of the hill. On a bandy-road south-easterly of the Skull Reef there are thin ferruginous veins containing numerous cubes of iron-pyrites decomposing into limonite which are said to be highly auriferous. The "casing" of the reef throughout is generally a talcose schist.

There is another reef within the boundaries pointed out to me, west of Wright's Level and one near the Alpha Bungalow. Neither of these has been opened by the Company.

THE MINES.

Now that the thick and high grass is burnt on many of the ridges, it is comparatively easy to follow the outcrops of the reefs and to discover old native workings. Since this report was commenced, I have examined very extensive native workings south and west of Wright's Level quite on the edge of the ghât. The ridge southward of the Alpha workings has been sluiced on both sides, and a channel has been cut in the valley about five feet in width and eight feet in depth for a length of more than three hundred yards. There are also numerous subsidiary small channels and deep and large excavations. On following the main channel downwards (it commences at the outcrop of the reef at Wright's Level) in a direction 8° south of west a strong vein of quartz is found nearly three hundred and fifty yards from the Alpha workings. One shaft has been sunk here, but the reef has not been excavated. It appears to have a strike of N. 30° W., and is probably a continuation of that which crops out in the jungle on the further side of a stream trending towards the ghât. The existence of these native workings and the reef referred to is, I am informed, unknown to the proprietors of the Alpha Mine. Surrounding the recent excavation at Wright's Level, there are other native workings evidently very ancient. There are several shallow pits and small excavations; and heaps of broken quartz are to be seen all along the strike of the reef. At one place, between Wright's Level and the Skull, there is a shallow pit communicating with an aperture like a chimney in which it is probable the quartz was roasted.

Near the Skull and for some distance northwards the workings are numerous, and at the Skull itself there is an excavation, the full extent of which cannot be ascertained as the roof has fallen; as far as it can be examined, it shows a width at the entrance of twenty-nine links, a breadth at the broadest part of fifty-three links; and it measures seventy-five links to the mouth of a drive which cannot be followed until some expenditure is incurred in clearing it and securing it. The height of the excavation from floor to roof is twenty-five links. There are vertical shafts communicating with this excavation which no doubt were sunk long before the adit was commenced. The amount of work done on the reef is conclusive proof that the native miners found gold in quantities sufficient to remunerate them. They appear to have dug into the soft casing and taken stone from the footwall, but they did not confine their operations to this part of the reef. They followed the run of gold wherever they were able to do so.

According to the information I have been able to obtain, it appears that the Alpha Company commenced their mining operations by quarrying stone in the old native workings at the Skull, where they took out about one hundred tons of quartz. Subsequently they quarried stone near Wright's Level, and then the adit named Wright's Level was driven for a length of about twenty feet.

At a point a little more than ninety feet eastward of Wright's Level and twenty-five feet below it an adit forty-two feet in length, five feet in width, and six feet in height was driven to cut the reef, and the reef is now seen in the "face" where a hole has been sunk in quartz to the depth of five feet. The Company or the Tributers also put down a shaft east of but quite near Wright's Level. It was sunk to the depth of forty feet where the reef was struck, and it is said good stone was got from the bottom. Further northward, but still within a few yards of Wright's Level, a shaft was sunk to the depth of sixteen feet and an adit was driven, cutting the shaft about five feet from the bottom. This is known as "Harris' Tunnel." On the slope of the range towards the ghât, and about three hundred and thirty feet east of "Harris' Tunnel," another adit was driven evidently for the purpose of cutting the reef. It has been continued for a distance of over fifty feet. It is not timbered, and near the mouth there is a fall of earth. It has intersected a small vein of quartz. It is nearly on the same level as the other adit below Wright's Level. A shallow pit was sunk south of the large excavation at Wright's Level with, I am informed, good results.

Another shaft now filled in and completely covered with broken quartz was sunk on the dip a few feet south of Wright's Level. It was fourteen feet in depth and a drive was put away for a distance of fourteen feet. It is stated that rich stone was got in the shaft and drive. Subsequently rich stone was broken out, it is said, at the north-western corner of the excavation.

The excavation at Wright's Level, as it appears at present, is eighty feet in length, twenty-two feet in breadth, and from ten to fifteen feet in depth.

Near the excavation at the Skull and about fourteen feet below it some native workings were re-opened by those who had the management of the mines. What is known as "Binny's Level" is situated a little distance northward of the Skull. The reef was cut here about twenty feet from the entrance. Still further northward is "Ryan's Level," which is about twenty-five yards from the battery. A commencement only was made with this work. Indeed it may be described as a hole from which broken quartz—the results of native labor—was carried away to the battery. An adit

known as "Withers' Level" not far from the works was driven about fifty feet and then abandoned. It did not cut the reef. It was undertaken prior to the formation of the Alpha Company.

It would seem then that quartz in some quantities was taken and crushed by the Alpha Company and Tributers from the Skull, from the excavation at Wright's Level, and from shallow pits and short adits near Wright's Level, and that seven adits were driven at various points and two shafts sunk which, even where the reef was struck, were, for reasons probably known to the Managers, discontinued. These works, the seven adits and the two shafts were unproductive, and it would be difficult to discover why they were undertaken at all. Having regard to the position of the battery nothing was to be gained by making adits east of Wright's Level.

It is probable that the Company expended some moneys in other similar works not known to me. I have, however, made every effort to ascertain the facts.

Yield of Gold from Quartz.

It will be apparent from the statements already made that little has been done to develope the reef within the boundaries of the Alpha Company's area or to determine its value. The apparently purposeless scratchings on the surface and the useless expenditure of moneys in driving short adits and sinking shallow pits have not even had the result of proving the character of the reef except at one or two points. It is however, evident, from the character and extent of the native workings and from experiments made in the laboratory, that the stone in some places is highly auriferous.

The yields obtained by myself have been as follows :—

Wright's Level.	oz.	dwts.	grs.	
1. No gold visible in the stone at the rate of	0	11	6·0	per ton of 2,240 lb
2. No gold visible in the stone ...	2	16	1·6	" " "
3. A little gold to be seen ...	56	13	19·5	" " "
4. Gold visible in the stone ...	204	11	16 7	" " "

Large blocks of quartz were broken out at the spot where the stone giving these results was obtained ; and in several of these gold was visible. In one or two instances loose gold was found in cavities ; and indeed some of the quartz was so rich that if portions of it had been tested the yields would have occasioned excitement amongst persons not acquainted with quartz mining, and unheedful of the cautions and statements which would necessarily have accompanied the report of any such yields. According to the judgment of those well able to form an opinion, some of the quartz from the reef near Wright's Level would have yielded at the rate of 1,000 oz. or more per ton. The value of the reef however cannot be measured by such results. Where this quartz was obtained, the vein is about four feet in thickness ; and the heaviest gold is found mostly in the upper part of the vein, as it is now exposed, and near the footwall, throughout a thickness of two feet only. It is to be followed downwards across the line of dip for a distance of sixty feet, where there is good stone showing gold near the footwall. Quartz with pyrites obtained from the adit below Wright's Level, and not on this run of gold, gave at the rate of only 3 dwts. 23·01 grs. per ton.

At the face of the large excavation at the Skull, a vertical section of the reef was taken, and the results for the several parts were as follows :—

	Rate per Ton. oz.	dwts.	grs.
1. One foot in thickness (hanging wall) ...	0	0	16·19
2. Three feet in thickness	0	0	9 92
3. Four feet in thickness	0	1	2 20
4. Five feet in thickness...	0	2	2·21
5. Six inches in thickness	0	0	4·25

Northward of the excavation and within a few yards of it the run of gold is found, and quartz from that portion yielded at the rate of 1 oz. 4 dwts. 5 grs. per ton.

Mr. W. King, B.A., the Deputy Superintendent of the Geological Survey of India, estimated from preliminary crushings made by him that the yield per ton of the reefs in this district would be 7 dwts., and he refers to the results obtained by the Tributers who worked at Wright's Level, *viz.*, 11 dwts. and 17 dwts. per ton.

In the table attached to Mr. King's report in the *Records of the Geological Survey of India* (No. 3—1878, Vol. XI.) it is stated that 769½ tons crushed by the Alpha Company gave an average yield of 2 dwts. 9 grs. per ton. One large parcel included in this return yielded only 1 dwt. 17 grs. per ton, but another parcel—6½ tons—treated at the Wynaad Prospecting Company's works, yielded 19 dwts. 22 grs. per ton.

In a report, dated 2nd April 1875, Mr. King writes as follows :—

"Among the lodes detailed above [referring to a table] the Skull Reef about to be mined by the Alpha Company was tried most carefully by seven parcels of quartz obtained from one cross-cut through the reef where it is 15 feet wide. There was no gold visible in the sample which gave the proportion of 25·92 dwts. to the ton. This rich proportion of gold is from a band of laminated quartz about 2 feet thick, within a couple of feet of the footwall or underside of the reef. The average proportion from this two-feet band would be 22·68 dwts., or taking the 10th, 12th, and 13th feet of the 15-feet cross-cut, from each of which I have samples, we get a proportion of 16 dwts. for what appears to be the richest part of this reef. The work was done by hand and dry crushing."

In a pamphlet entitled "Gold Prospecting in the Wynaad" a table is given, which purports to be an extract from a report made by Mr. King. The experiments were made on quartz taken from the Skull Reef, and they are as follows :—

Appearance, Color, &c.	Results.	Depth in cross-cut from back of reef.
Compact, coarse texture, laminated, white color	2 dwts. to ton.	1st foot.
Still white in color but stained with ferruginous matter	2·5 dwts. to ton.	3rd foot.
Whitish, discolored with iron ...	None.	5th foot.
Whitish, discolored with iron, good color in dish-host in amalgamation ...	......	7th foot.
Still white but ferruginous matter ...	5·18 dwts. to ton.	10th foot.
Highly colored, red and brown, ferruginous cellular with white iron pyrites : gold visible	19·44 dwts. to ton.	12th foot.
Highly colored, red and brown, washed and amalgamated in my presence by Mr. Withers ; gold not visible ...	25·92 dwts. to ton.	13th foot.

In a printed report made by Mr. R. Lindon to the Directors of the Alpha Company there are results of trials as follows :—

	oz.	dwts.	grs.
Quartz from Wright's Level, picked specimens ...	25	13	0
Quartz from Wright's Level, picked pieces without gold visible	11	18	0
Quartz from Skull working	0	6	16

It would be altogether injudicious to attempt to give an average from the above results ; but they are sufficient to prove that the reef within the boundaries of the Alpha Company's area is in some parts highly auriferous, and, having regard also to the large extent of native workings, that its character is such as to justify a Mining Company in opening it thoroughly with a view to the erection of works for treating the quartz.

The Machinery and Works.

The machinery consists of a battery of fifteen stamps, in three groups of five and a fourteen horse-power steam-engine having a tubular boiler and a fire-box constructed to burn coal. It was intended that this engine should drive also a pulverizer and a circular saw, both of which can be connected with the engine and are under the same roof as that which covers the stamps and the engine. The stamps, including the shanks and discs, are said to weigh about 3½ cwt. each, but they appear to be very much heavier. Motion is given to the stamps by cams attached to a shaft. The coffers in which the stampers work have in front of them only (and not at the back) perforated iron plates with 125 holes to the square inch. There are three copper plates, four feet six inches in width—one is seventeen inches in length, one three feet eleven inches, and the lowest twenty inches. These are divided by ripples. The angle of inclination of the plates is from 3° to 3½°, but they are not even. They bulge a little in some places. The tables are from ten feet eight inches to twenty-six feet in length, each group of stamps having tables of different lengths ; each table is in three partitions, seventeen inches in width ; the angle of inclination of the tables is 6°. The blankets were nine feet in length, and only nine feet in length of the tables were covered with blankets. The tailings ran through launders to catchpits.

A small furnace for roasting the tailings, a retorting furnace and kilns for roasting the quartz previous to crushing, complete the list of appliances at the mill.

The information I have received furnishes a melancholy history of the various attempts to work the machinery. When it was erected it is said, it worked very well, that is to say, the machinery moved smoothly, but it never crushed any such quantities of stone as ought to have been crushed. One day about eight tons of stone were crushed ; but the Alpha Company crushed, at the best of times, only seven tons in twenty-four hours, and even this rate would not be maintained. It was found impossible to move the stamps, the pulverizer and the circular saw at the same time. The engine, it is stated, was worked at a pressure of 60lb., but it was never possible to keep up steam. It usually took three hours to get up steam. No firewood was stored. It was cut green, and even old wood that was gathered was often quite wet.

The present condition of the battery and tables is, of course, worse than it was when they were erected. The weather and use have injured them ; and one of the Managers in order to re-arrange the tables of the middle battery, according to his ideas, cut away one of the main bed-logs, and since that was done the vibration has been so great, with the machinery in motion, as to shake the tables to pieces. The wood of the tables is shrunken and warped , there are numerous apertures through which water, quicksilver, and amalgam could escape ; and I am told that 35lb. of quicksilver were found under one table. The fall from the coffers is not on to the plates ; there is a space of over an inch between the plates and the edge of the coffers, and even now the course which the water and tailings took as they escaped through this aperture is plainly to be seen under the tables. The fastenings, too, are bad ; the nuts and washers below the coffers do not cover the holes in the plates for the bolts, and the mercury and amalgam fell through the spaces thus exposed. Some of the arms of the drum for the belt connecting the engine with the pulverizer are broken, owing, it is supposed, to their having been screwed up too tightly.

The pulverizer is said to have reduced the tailings to a fine powder, but the quicksilver "floured" owing to the iron pyrites not being properly roasted.

About 10 cwt. of "tailings" could be ground by this machine in a day. Owing to the condition of the machinery I would not deem it prudent to put the pulverizer in motion. It is to be noted that the taps through which the quicksilver or amalgam flows from the pulverizer are made of brass. They are now nearly entirely eaten away.

The Treatment of the Quartz and the Results.

From information furnished by the Directors, it appears that mining operations were commenced by the Alpha Company in February 1875, and ceased in March 1876, and that the total quantity of quartz treated from first to last was 779½ tons. The time occupied in crushing and treating this quantity was seven months, including stoppages. The gold obtained weighed 91 oz. 12 dwts. 23 grs., being at the rate of 2 dwts. 8 13 grs. nearly per ton. This is inclusive of six tons and-a-half which were treated at the Wynaad Prospecting Company's works for the Alpha Company, and which, as already stated, yielded at the rate of 19 dwts. 22 grs. per ton. The average cost of raising quartz was Rs. 2 per ton; the average cost of conveying the stone to the mill was Re. 1-8 per ton, and the average cost of crushing Re. 1-13 per ton. The total cost of rasing and crushing quartz is stated to have been Rs. 2,971-6.

To these must be added the following items as given in the statements furnished by the Directors:—Firewood (estimated) Rs. 50 (per week); timbering in the mine, Rs. 150; blasting-powder, Rs. 700; and quicksilver (quantity used not known), Rs. 3,000. The cost of supervision is set down at Rs. 2,384 for seven months only. The machinery is stated to have cost Rs. 25,000, and the erecting of it about Rs. 1,800. The construction of roads cost Rs. 795-7-7.

The aggregate of these sums, including interest on the capital invested, shows that the quartz, for raising, treating, supervision, stores, &c., must have cost more than Rs. 15 per ton or, to put the matter in another way, that the gold was obtained at an expense of Rs. 127 per ounce.

The balance sheet of the Alpha Company, prepared by the Secretaries and Treasurers (copy hereto marked A*) shows that the sums expended in preliminary expenses were Rs. 8,708-4-5, and in supervision, management &c., Rs. 14,675-11-9; and the only point in the statement that is really important is the relatively small sum expended in actual mining operations, which under the head of "Mining, Felling, and Storage" is set down as Rs. 11,327-0-10. The value of the gold got, the result of these operations, is stated at Rs. 3,037-6-3.

The stone treated at the Wynaad Prospecting Company's works, six tons and-a-half, was got from the reef at Wright's Level, and it cost for sinking the shafts and raising Rs. 70-10; for breaking Rs 3-10; for conveyance to the works Rs. 21; and for crushing Rs. 65—total Rs. 160-1.

The gold got sold for Rs. 297-6-3. The stone treated by the Alpha Company at their works was not roasted before being sent to the mill; but the "tailings" collected in the settling pits were roasted in a furnace and ground in the pulverizer. I have not been informed as to the result of the treatment of the tailings.

The stone crushed for the Alpha Company at the Wynaad Prospecting Company's works was roasted before being crushed.

"The Prince of Wales Quartz Reef Gold Prospecting Company" took possession of the Alpha Works on the 1st June 1877 under an agreement with the Alpha Company. They commenced mining operations on the 17th August 1877, and continued to mine with some interruptions until the end of February 1878. The pecuniary results of this adventure are shown in the balance sheet hereto marked B.* The value of the gold got, including specimens, is stated at Rs. 8,132-10-3.

Copies of the reports furnished by the Manager, as well as several papers relating to this Company's proceedings, have been placed in my hands for perusal by one of the proprietors, and I gather the following facts from them:—

QUARTZ CRUSHED AND TREATED.

	Tons.			Average Yield per Ton. oz.	dwts	grs.
Wright's Level	41¾					
Skull Reef	63					
	[illegible]4¾	...	...	.. 0	2	18 5
Skull Reef	1	...	...	.. 0	2	5
Wright's Level	6	...	...	... 0	11	19
Do.	50	...	...	... 0	16	12·5
Do.	104	...	...	... 0	14	21·34
Do.	2	...	...	... 0	8	0

The average yield per ton from these parcels was 10 dwts. 12 grs. nearly. Pieces of quartz containing gold were sold for Rs 1,251-4. The "specimens' containing gold got from the parcel of 104 tons are said to have been sold for Rs. 920, and it may be assumed therefore that the stone was very rich.

There is not much information to be obtained as to the mode of treatment pursued by the Alpha Company, but it stated that the stamper-boxes were charged with quicksilver, not largely, and that they relied mainly on their copperplates and ripples for saving the gold. They used sodium amalgam very freely.

The Manager of the Prince of Wales Tribute Company has furnished many details respecting the mode of treating the quartz when the results of the operations were apparently to some extent satisfactory to the shareholders.

Kilns were built, and the stone before being sent to the mill was roasted. Wood was placed in the kilns and the stone piled thereon and the roasting was continued for forty-eight hours.

He informs me that a small quantity of quicksilver was put in the coffers, two or three times a day according to the estimated richness of the stone. On the copperplates 2½ per cent. of sodium amalgam was used with the quicksilver, and in the pulverizer as much as 3 per cent. Still the quicksilver "floured."

Blankets of the ordinary kind were used, and the length covered by the blankets was nine feet. They were washed every half hour. It seems that all the tables were for this length covered with blankets and the water was allowed to spread itself over the whole.

Water was conveyed to the mill through troughs which discharged into a tank, and an iron pipe, fed from the tank, was fixed in front of the battery. To this were attached smaller pipes provided with taps, two to each battery and when the supply was sufficient the water must have entered the coffers with great force. The flow, however, was not even, the smaller pipes were often choked with grass, and owing to the troughs or boxes being badly made and improperly placed, the water escaped and sometimes there was not sufficient for the tables.

The stone was broken by hand before being sent to the mill, at a cost of nine annas per ton.

The feeding was very irregular. It happened not seldom that so much quartz was put into a coffer as to stop the action of the stamper, and at other times the coffer was not fed and the disc struck upon and injured the cam.

Oil from the machinery often dropped on the plates and it found its way also into the coffers.

Tailings escaped from the catchpits.

The stone treated, as already mentioned, must have been rich. In one "cleaning up" of a stamp-box coarse pieces of gold were found weighing from 6 grs. to 3 dwts., and of these about thirty were obtained; one piece weighed about 7½ dwts.

Causes of Failure.

The first important step taken by the Alpha Company was to erect machinery, and subsequently they made attempts under the advice of various Managers to open their main reef. As stated in another part of this report they first quarried stone at the native workings on the northern extension of the reef, and subsequently at the southern portion of it, but no successful effort was made to mine systematically. There was consequently unnecessary cost incurred in getting stone, and great cost in conveying it to the mill.

There was no stone-breaking machine at the mill; the stone was broken by hand. There was no self-feeding apparatus; the feeding was irregular; and the platform on which the quartz was delivered was not partitioned off from the stampers and engine. The dust rose sometimes in clouds and fell on the bearers, injuring them and rendering necessary a large supply of oil, &c., for lubricating the various parts of the machinery, some of which often dropped on the plates, thus making effective amalgamation impossible, even if there had not been other detrimental influences in operation.

A great error was committed by the Tribute Company in roasting the quartz in kilns before sending it to the mill. Nearly all the quartz in the reef is more or less pyritous, and the percentage of iron pyrites, in several sections probably varies from 0 1 or less to 5 per cent., and when this is placed in a kiln in the manner described elsewhere in this report it is impossible to oxydise the sulphur. The fusible lower sulphides coat the gold and prevent its amalgamation with mercury. The roasted stone I have seen in Devalah is often a slag, and any gold in it must be "glazed."

Sodium amalgam appears to have been used in excessive quantities. This amalgam has all the valuable properties ascribed to it by the patentee, Mr. William Crookes, F.R.S.; but the utmost care and caution are necessary in using it in the extraction of gold and silver. A very minute quantity of sodium amalgam added to quicksilver has the effect of rendering the metal more mobile and more "eager" for gold, and therefore it is the more likely to escape from the mill and carry the fine gold with it unless the ripples are properly arranged and other precautions taken.

It was a mistake to put quicksilver in the coffers. The undecomposed pyrites, reduced to powder, would accumulate in the coffers and cause the "sickening" and "flouring" of the mercury. The metal breaking up into minute globules or adhering to the powdered pyrites would be carried away.

If no quicksilver had been put in the coffers the copperplates might have been dispensed with.

The inclination of the tables was excessive. Instead of 1 in 10 they should have been not more than 1 in 14 or 1 in 16.

The water from the battery (often insufficient) was allowed to spread itself over the whole extent of the tables, whereas, as there was not sufficient water, but under any circumstances, it should have been so regulated as to carry the tailings evenly over the blankets. And the length of the blanketing, nine feet, was not enough. I have been informed that iron pyrites from the Alpha Mill was taken out of the bed of the stream quite 200 yards away, and that it was found to yield 1 oz. to the ton.

Buddles were not used for concentrating the tailings, and a large proportion of the stuff sent to the furnace must have consisted of quartz

* Not published.

The furnace which was built by the Tributers is unsuitable for treating pyrites.

The steam-engine was never equal to the duty required of it. One of forty horse-power would be needed to drive the stampers and keep in motion the pulverizer, fully charged, and the saw. The Alpha Company and the Tributers are said to have crushed 1,102 tons of quartz in fifteen months; if the machinery had been effective, and if the works had been skilfully managed, at least 11,000 tons should have been reduced in fifteen months.

During the whole period that the works were in operation, when only an average of 2·8 tons were crushed per diem, the expenses of management, deadwork, &c., were running on as well as interest on the capital invested, and it is not a matter for wonder that doing only one-tenth of the work that ought to have been done the two adventures were not remunerative.

The greatest credit it appears to me is due, however, to the projectors for their spirit and enterprize. They failed because they did not first of all commence to mine, and because they had not appliances for saving gold.

How the Operations should be Conducted.

A run of gold in the main reef is found at Wright's Level, and this has been followed for a distance of sixty feet. I would advise that in the first instance this run should be followed still further on the underlie—say—if the good stone continues—for 100 feet or 150 feet; that the shaft should be well and safely timbered, and that skids should be put in so that the quartz might be brought to grass with facility. It may be assumed judging from the stone already taken out, that the quartz from this shaft would yield a fair proportion of gold.

This preliminary work, but productive, would indicate the best site for a main adit, and that will be found at a point on the slope of the ghât eastward of Wright's Level.

This main adit running west should be driven at a low level so as to intersect the reef at a considerable depth below the outcrop on the ridge.

From this adit and other cross-cuts the reef could be mined economically. It could be stopped from different levels quite up to the surface. A site for the battery could be found near the mouth of the main adit. All these undertakings and all arrangements connected with them should be well considered, and the objects in view should be to open the mine on a good plan, and to raise a large quantity of stone which from careful assays should show such a yield per ton as would justify the erection of machinery.

I recommend that water-power be employed for driving the machinery, either an over-shot wheel or a turbine.

I regret to say that I am not sufficiently acquainted with the laws or regulations in force in India under which water may be diverted, but it would be no doubt practicable to arrange for the diversion of water from the stream near the Wynaad Prospecting Company's works.

Perhaps reservoirs would have to be constructed for storing water.

The relative cost of using steam and water in this district cannot be fairly estimated by me, as I am ignorant at what cost fuel could be go if proper arrangements were made for procuring it in large quantities, but in mills elsewhere the proportions are—for water about 1·2, and for steam 2·1.

There is not much at the Alpha Mill that could be used in any new adventure. The stamps could be made available, and the coffers seem to be uninjured and might again be set up; but in my humble opinion it would be more economical to procure a new plant furnished with all the best appliances than to patch up the machinery at the Alpha.

All patent contrivances that have not been proved to be of value by a lengthened experience should be rejected, and only those adopted that are known to have yielded good results and now find a place in the best conducted mines.

As well as a battery there would be required :—

(*a*).—A stone-breaking machine. The smaller pieces of quartz would be separated from the larger and sent direct to the stamps and the latter to the stone-breaking machine.

(*b*).—A self-feeding hopper.

(*c*).—A buddle for concentrating the "tailings" which are saved in the settling boxes.

(*d*).—An inclined reverberatory furnace for roasting the "tailings." This would consist of a fire-box, hearth, &c., and should be on the plan of some of those that have given the best results in Victoria.

The quartz should be crushed raw. Quicksilver should not be used in the coffers; and copper platforms are likely to cause a loss of amalgam, and I do not recommend that they should be employed. Ripples and blanket-strakes will do the work more effectually. The tables should be twenty feet or more in length, and about fourteen inches in breadth for each stamp-head; the fall should be about one in sixteen (if a good supply of water is maintained), and they should be covered with closely woven green baise.

Experience would of course lead to some modifications in the arrangements, but it would not be difficult to adjust the length and fa. of the tables so as to meet any conditions that might arise.

Summary.

I have endeavoured to indicate as briefly as possible the causes which prevented the Alpha Company from obtaining profitable results from their adventure. I am satisfied that their machinery and appliances are such as to make it impossible to save the gold even if the best scientific and technical knowledge was brought to bear on the operations. The one fact that oil and grease were allowed to fall on the copperplates and to get into the coffers is sufficient to show what the state of affairs was when the best results were obtained.

The main reef within the area held by the Alpha Company is nearly 2,000 feet in length; it is from 4 to 14 feet (at least) in thickness; in one part the quartz is of extraordinary richness; and other parts have yielded well.

Native miners have picked what must have been auriferous quartz all along the outcrop, and at the "Skull" their excavations are extensive. The position of the reef and the formation of the ground both offer facilities for economical mining.

It appears that the yields of gold have been for 779½ tons of quartz 2 dwts. 9 grs., and for 322 66 tons, 10 dwts. 12 grs., and the gold was got, as I have shown, under the most disadvantageous circumstances.

These results may be compared with some operations in Australia.

The compilation of mineral statistics was commenced in Victoria in 1860, and from 1860 to 1876 (inclusive) information has been obtained respecting the results of the treatment of 13,402,915 tons of quartz, and the returns show an average yield of 11 dwts 6·30 grs. per ton. The average yield of gold from 1,011,808 tons crushed in Victoria during the year 1876 was 10 dwts. 13·48 grs. per ton.

The Black Hill Company at Ballaarat crushed 283,550 tons, which yielded an average of 2 dwts. 23 grs. per ton and the dividends paid amounted to £23,900. It is stated that the machinery costs £10,030, and that the company paid £24,235 for "claims" (*i. e.*, land on which to mine).

Other Companies have treated large quantities of quartz yielding averages per ton of 2 dwts. 18·4 grs.; 3 dwts. 6·01 grs.; 3 dwts. 7·89 grs.; and 3 dwts. 18·53 grs., and have paid dividends.

The prices paid by the Alpha Company and Tributers for labor, for timber, and for firewood are no criteria to guide me in estimating the costs of mining at Devalah. Under skilful management arrangements would be made for procuring all necessary supplies at the minimum cost, but in desultory operations the maximum cost as a matter of course has to be paid.

In reply to the questions in the paper, dated 10th January 1879, No. 47, I can safely say that the want of success of the Alpha Company has not arisen from any peculiar difficulties in separating the gold from the matrix, and I cannot believe the cost of labor or fuel would be so great here as injuriously to affect mining pursuits.

In this report I have omitted all details that appeared to me not necessary to the full elucidation of the questions with which I was instructed to deal.

Note.—The late Manager of the Prince of Wales Tribute Company states that the wages paid for native labor were from four to five annas per diem; the cost of fuel was Rs 3 per ton; the cost of drilling in hard rock was four annas per foot, and in soft rock two annas per foot; and the cost of driving such adits as are seen here varied from six annas to Rs. 3 per foot.

The cost of carrying stone from the "Skull" to the battery was six annas per ton, and the cost of carting stone from Wright's Level to the battery was thirteen annas per ton.

The Planters' Gazette.

TEA.

THE Under-Secretary to the Government of India has forwarded to us a communication on a sample of Puérh tea which has been received through the good offices of the late Commander-in-Chief of Yunnan, Tang Yü ko. This tea is said to be highly prized "at the Court of Pekin, and is also esteemed by the "Chinese generally for its invigorating properties."

The sample has been placed in the Economic Museum, and the Government promises to make known sundry further information on this subject which her Majesty's Consul at Shanghai has been asked to obtain, if possible.

The prospects of the season do not improve, true the weather is better than it was earlier in the season, and larger quantities are now being made, but the ruling prices in the market are so low, that the year promises very badly as to dividends, and we do not see much hope for a change, until Indian tea is sold at home, pure and unmixed, and judged on its own merits.

The quantity of tea exported from China and Japan to Great Britain this year from the commencement of the season to the 11th August, was 80,387,883lb., as compared with 103,435,117lb. exported in the corresponding period of last year. To America the quantity shipped this year was 22,978,256lb., whilst last year 12,711,260lb. only were exported.

In a private letter recently received in Calcutta from an Anglo-Indian now in Australia, the writer expresses his regret that Indian traders have not realised what a splendid field is open to them in the colonies. He says.—"There is a peculiarity about the merchants here, *viz.*, they don't like to go out of a beaten track.

They have always (for instance) had tea from China, and continue to get it thence, although it is vile stuff. I have not had a cup of good tea since I have been here. They know that India can supply better tea than the refuse from China, which comes here, but they won't get it, because they have never got it. But if any firm in Calcutta were to send out a few thousand pounds, they would soon be convinced that it was appreciated here, and would prefer consigning at least a portion of their stock to Australia. The wretched stuff that comes from China sells here (wholesale) at 1*s.* 9*d.* to 2*s.* 6*d.* per lb., after paying duty at 9*d.* per lb. Coffee is 3*s.* 6*d.* per lb., and if disposed of in lots of 1 and 2 maunds, would realise more, as the grocers sell it roasted and ground, which means an extensive admixture of chicory, or something worse."

A CORRESPONDENT of a London class journal says that, with the sole exception of 1870, for the past twelve years, China tea has been poured into England between July and October at prices resulting in an average annual loss of from £600,000 to £700,000, but the present season has never been equalled in this respect since the ports were opened. A trade conducted on principles so reckless as these, re-acts to the great disadvantage of those engaged in the Indian tea business; and prices oscillate in a way most vexatious to the steady trader, and compel him to accept further risks in an enterprise which is sufficiently anxious and doubtful at the best of times. It appears that at the beginning of the present season a combination of merchants was formed at Hankow for the purpose of depriving the Chinese sellers of the entire command of the market which they have hitherto had. It was agreed mutually that no teas should be offered for, either directly or indirectly, until a later date than usual, and that no teas should be shipped to London on native account before the specified date. This scheme seems to have been successful at Foochow, some grades having been obtained at prices 40 per cent. below those paid last season. But at Hankow the arrangements proved a dead failure, and the buying broke away into independent competition and soon became wild and rapid. The future bodes no good to the speculators for the London market, which had been nursed to firmness at the early part of the year, shows a decline of as much as 20 per cent. since the first arrivals.

"AN Old Darjeeling Planter" writes:—In an account of tea planting in Darjeeling, extracted in the *Statesman* of 11th August, it is stated that plantations in the Darjeeling terai, give *as much* as ten maunds of *green leaf* per acre. This is an obvious mistake, and forty maunds of green leaf or ten maunds of made tea must be what is intended. A fair outturn in the hills would be about four maunds of made tea per acre. I myself have made sixteen hundred maunds off 320 acres, or five maunds per acre, in a hill garden of average elevation and within exceptionally favorable circumstances, and I have known one thousand maunds of tea to have been made off a one hundred acre garden in the terai.

TEA ON THE NEILGHERRIES.

TEA manufacture is in full swing, and leaf comes in so ploutifully and in such regular quantities, that the firing establishment is kept day and night at work. We hope the price of tea at home will prove remunerative hereafter. The depression in the tea market has caused a serious and somewhat unwarranted depreciation of tea property on these hills. Those, however, who have given the manufacture the proper care and attention have not had reason to despond, though they also would like to see the Indian article accepted at its real value.

JAVA AND JAPAN TEA.

THE tea crop of Java in 1878 is estimated at 6,900,000lb., of which 4,700,000lb. went to Holland, and the remainder chiefly to England, though 370,000lb. were shipped to Australia. It is difficult to make out the actual import of Java tea into England, as a great deal is transhipped to this country from Holland, and our official returns only give China and Indian teas separately. In 1878 3,707,235lb. of tea were imported into the United Kingdom from countries other than China or India, but this may include a good deal of China tea sent indirectly as well as Japan and Java teas. The imports of Java tea into London in 1878 were shown by the Brokers' circulars to be 2,653,980lb., and this, no doubt, practically represents the entire import into the United Kingdom. In the first six months of this year the imports of Java tea into London were 1,351,000lb., against 887,000lb. last year. The deliveries had not quite increased in proportion, as the stock had risen from 841,000lb. to 1,028,000lb. It is a pity that the Java Planters cannot give their teas more strength, for they already prepare the leaf very well, while the flavour is fair. They should imitate the Assam Planters' processes. The imports of Japan tea into London in 1878 were under 300,000lb.,—a small proportion for the largest tea-market in the world to receive, out of a crop supposed to yield about 40,000,000lb. a year. The reason of course is that the uncoloured green teas of Japan is unsuited to this market, where we appreciate rougher teas and strength more than a fine delicate flavour. The Japanese, as is well known, have for some years past been experimenting with a view to meet the English taste, and this ought not to be difficult for so ingenious a people.—*Produce Markets Review.*

TEA-ROLLING MACHINERY.

(*South of India Observer.*)

LAST month we noted the fact that Mrs. Barlow, the wife of our Commissioner, had at Kotagherry inaugurated the working of certain new tea machinery by steam power. We have now the pleasure to present to our readers a description of that machinery.

These estates, lying in the eastern extremity of the hills, about 10 miles beyond Kotagherry, the property of Mr. Thomas G. Hill, of London, comprise about 1,000 acres forest land, of which about 700 have already been opened up, and are now under cultivation in tea, coffee, and cinchona; by far the largest portion, however,—over 450 acres, being under the former product. A half-sized Jackson's patent tea-rolling machine, driven by steam power, has been at work for upwards of 3½ years, and gave every satisfaction; but the yield last year having greatly increased, it was found, not only the machine, but those in charge of it, were too heavily taxed, about 113,000lb. tea having been turned out, which represents the large quantity of 452,000lb. green leaf which passed through the machine. Sometimes as much as 4,000lb. green leaf (1,000lb. dry tea) were in a day brought to the factory to be rolled off in the machine, and on such occasions it seldom stopped day or night. To cope with this increase, Messrs. W. & J. Jackson, the inventors of tea machinery, about two years ago, brought out a much improved rolling machine, and one of which, a Jackson's sifting machine, and a saw-mill, were sent out with a 10-horse power horizontal engine to drive them. Great difficulty was experienced in obtaining a conveyance of sufficient strength to carry the latter up the ghâts and on to the estate, the boiler weighing about 8½ tons, the engine near 4. After considerable delay a trolly, admirably suited to the work required of it, was obtained from Messrs. Stanes & Co., and on this the most cumbersome parts of the machinery (the engine and boiler) were brought up. These were duly set in position, and the rolling and sifting machines laid down opposite on beams built into a masonry floor. Messrs. Jackson's new rolling machine (the one just erected) differs chiefly from their original invention in that not only the upper rolling box, but also the lower table, supported by four spiral springs, and lying on a strong iron frame, is driven direct and works in two grooves underneath it. The upper rolling box, by a very ingenious arrangement of "bevelled cogs" and a side crank rod, works backwards and forwards on two horizontal slide bars at only half the speed at which the lower table moves, thus securing a very powerful roll, and at the same time a twisting motion. The machine is again covered with a large upper table on which the man in charge is stationed. An oval cut in the centre of this admits of the leaf to be rolled being pushed into the rolling-box through the feed-funnel, and as soon as full, a wooden plug is inserted and bolted down. The machine is then set in motion at 60 revolutions per minute, and as the leaf gets rolled, and consequently occupies less space, by means of an ingenious arrangement of steel rods with grooved wheels at each end, coupled with a strong iron chain working reverse ways, and again to which another set of chains are attached and fixed to the lower iron frame, all worked by a side wheel, the lower rolling table is gradually brought up against the rolling-box, the pressure increasing as the spiral springs become contracted. The machine holds 160lb. leaf, which is perfectly rolled in 20 minutes, at the end of which time it is discharged through a trap door in the centre of the rolling table on to a large tray pushed in underneath on rollers to receive it. The machine is driven direct from the main crank shaft of the engine by means of drums and belting.

The sifting machine, also one of Messrs. Jackson's inventions, is a simple long iron frame, divided into six paces, each containing a sieve to be lifted out at pleasure. The frame is fitted underneath with three tin funnels (two seives to one funnel) into which the sifted tea falls, and, by the motion of the machine which works at high speed backwards and forwards, is shaken out into a tin box placed underneath to receive it.—*South of India Observer.*

COFFEE.

COFFEE in Madras does not seem to prosper so well as in Ceylon. In the Report issued by the Madras Government on 22nd July 1879, referring to the results of cultivation in 1876-77, we find that the average outturn was 268lb. per acre. This seems very low, estimating the bean to be worth 80 shillings per cwt., this represents a total gross income of £9-11 per acre. There are 16,736 coffee plantations, having an area of 49,404 acres of mature plants, and 15,711 acres of immature. The cost of cultivation per acre is put down at £14-14, showing the absurdity of a department which knows nothing absolutely of the subject, collecting statistics, and utterly unable to tell whether the returns are correct or not.

EXTENSIVE experiments have lately been carried on with a view to arriving at a proper understanding of the causes of the coffee leaf diseases, and various remedies have been proposed and tried, but it does not seem to have occurred to Mr. Morris who conducted the last great inquiry with its resultant experiment, that the disease might not be a leaf disease at all. It seems to us that it is a root disease, caused as much as anything else by poverty of soil. The potatoe disease shows itself most markedly on the leaf and haulm, but it is nevertheless a root disease, and we feel sure that a general effort to improve the plant-food on which the coffee feeds, would result in a gradual diminution of leaf disease.

COMMERCIAL prospects cannot be so gloomy in Ceylon as we have been led to suppose. A Colombo paper tells us that half of an estate was sold the other day for Rs. 1,30,000, the whole place having been bought some years ago for Rs. 1,80,000, while a half share of an estate in Hapatale was recently sold at the rate of Rs. 1,300 per acre.

A CORRESPONDENT writes :—"You are quite correct in stating that this industry (coffee) is falling off. The intelligent planters of India and Ceylon ought, as you say, to produce the best coffee in the world, and so they do. But the reason why the cultivation does not extend in Southern India, which includes the principal coffee-growing districts, is the obstructive policy of the Madras Government, which persistently refuses to give a Labour Act ; to withdraw the existing vexatious restrictions on the sale of suitable land ; to make a railroad from the west coast to Mysore through the Wynaad, which is also necessary for future famine prevention ; or to establish a telegraph line of communication with the markets. Here is an instance of blind infatuation. An industry which is one of the principal sources of revenue and which might be trebled by judicious management, dwindling away, because the Government chooses to retain in its own clutches thousands of acres of land which do not pay a fraction to the State ; will not grant a Labour Act to protect the capital invested and better the condition of the cooly ; will not establish the easy communication with the ports which, had it existed during the last famine, would have saved tens of thousands of lives, and would in all human probability prevent the recurrence of these horrors. It will scarcely be credited that the cost of transport from the plantations to the port for shipping, a distance of sixty miles, is more than the freight to England. The consequence of all this is that there are no new openings ; old estates are dying out for want of cultivation, and planters are chucking up in disgust. Coffee production may drag out a weary life as long as the present valuable estates exist, but must eventually disappear, like everything else, if not renewed. There is plenty of capital and plenty of energy ready to be expended in the cultivation of coffee, and it rests solely with the Government whether or not this most necessary article of commerce shall be doubled in production, or disappear altogether from among the exports of India.

The planters have addressed the Supreme Government on the subject, and proprietors and merchants in England are in communication with Lord Salisbury.

The judgment in favour of the defendant in the Attapadi case will throw open a large extent of land suitable for coffee, which has already been applied for, and will now be placed under cultivation, and should the Government withdraw its injudicious obstructions to the sale of Crown lands in the Wynaad and consult its own interests and the public good by favourably considering the planters' appeal, thousands of acres of now profitless jungle would in a very few seasons be covered with valuable plantations.

PARASITE OF THE COFFEE PLANT.

A FRENCH paper says :—" It would seem as though all the plants from which man derives nutriment are destined to be victimised by various parasites. According to Dr. Jobert, the coffee tree is threatened in Brazil with complete destruction, just as the vine is in France. His observations were made at Cantegallo, in the Province of Rio de Janeiro, and elsewhere. It is the most vigorous coffee plants, seven to ten years old, that are attacked by preference. They grow yellow, and ere long die. On pulling them up, one finds their roots covered with nodosities or knots resembling those on the roots of phylloxerised vines. These knots contain cysts, in which are enclosed small nematoid worms, about ¼ mm. when fully developed Dr. Jobert estimates that one coffee plant may be attacked by 3. millons of these parasites.

LIBERIAN COFFEE.

LIBERIAN Coffee is now cultivated pretty extensively in the warmer parts of the island. This species, though by no means exempt from the attacks of the *Hemileia* does not appear at present to suffer so seriously from it as does the ordinary coffee, and it is believed that the cultivation of the Liberian coffee will prove to be a profitable one, and especially so if means can be discovered to check the leaf disease in good time. The few plants we have of it under cultivation in this garden, produce fruit copiously and nearly continuously. The beverage it furnishes is very highly flavoured, and to those who have tasted it, is generally pronounced agreeable. This bids fair to be an excellent substitute to the villagers for their own native coffee, so much of which unfortunately has nearly died out. With the sanction of Government a considerable number of plants and seeds of the Liberian coffee have been distributed free of charge, to the native villages.

A hope has been expressed that some species or varieties of coffee, grown in the West Indies, may prove able to escape the attacks of the *Hemileia*, and it has been considered very desirable that the subject be experimentally investigated in the gardens of this establishment and elsewhere, by the aid of specimens which, his Excellency has kindly offered to procure from the authorities of the respective countries where those coffees are now largely and successfully cultivated.—*Ceylon Report on Botanic Gardens.*

CINCHONA.

WE observe from a return furnished by the Madras Government that four plots of *cinchona succirubra* have been rooted up, on account of injury done by a hailstorm, and that their place was to be filled in with *cinchona officinalis.*

A LONDON firm write as follows to a Colombo merchant regarding the preparation of cinchona bark for the home market :—"We have been making inquiries on the subject of scraping the trees mentioned in a former letter. The solution of the problem lies with your planters, for we can only give, so to say, a trade opinion, though some of the people we have consulted have long made cinchona bark a study. The scrapings we have seen have been decidedly rich in alkaloid, and the question is whether the second growth will be equally good. This we imagine there has not been time to answer, but it is an all-important point, and if you could send us even a few ounces of this second growth, after the scraping, we would have it analysed. An impression exists here that the tree would not stand the scraping and that the second growth would rather be of the fibrous nature of the innermost bark left on the tree, than of the gummy quality taken off. The main thing for you is to find some substitute for moss, so as to adopt Mr. McIvor's process almost at any cost, for the so-called renewed Wynaad bark fetches the highest price of all. Could not coir fibre be used ? This is the more important, as a good article generally maintains its value, especially one so difficult to work as bark, and with the rapidly increasing production of common red bark this should be thought of."

VALUABLE INFORMATION REGARDING CINCHONA.

TO THE EDITOR OF THE CEYLON OBSERVER.

DEAR SIR,—Separation of different sizes and qualities of cinchona bark is not requisite. I called at Messrs. Jenkin and Phillips' last December and had a long conversation on the subject of cinchona. The most important items of practical use I gained were these :—

All the parcels offered for sale require to be analysed to obtain the true value but as the buyers cannot go to the trouble of analysing small parcels, they will only buy them with a safe margin, and it is a fact that small parcels do not realize in proportion to large ones. Again, as it is a question of analysis and *not of appearance*, the separation of large from small bark is *unnecessary*, as the buyer crushes the sample to a powder before analysing it.

I was advised to pack it altogether in good Calcutta bags and not in cases. I saw what appeared to be a coffee bag in the sale room, and was informed it was just the thing. It may be interesting to your readers to know that, in Mr. Phillips' opinion, the production of cinchona in Ceylon cannot be carried to too great an extent.—I am, dear sir, yours truly,

HENRY WALKER.

Beaconsfield, Rockwana, 28th July.

[We and our readers are much indebted to Mr. Walker for the information afforded. Messrs. Jenkin and Phillips are right, and Mr. J. E. Howard fully agrees with them : Cinchona cannot be overdone, in this country at least. We should think no package can be better than those we saw on the Nilgiris, and which we recommended a firm here to obtain through Messrs. Arbuthnot & Co. of Madras, or otherwise. They are bales, not bags, of double gunny, with tar between the folds, calculated to hold about 102lb., the 2lb. extra being for analysis.—ED. *C. O.*

WHITE-ANTS ATTACKING CINCHONA.

A PLANTER wrote to us (*Ceylon Observer*) some time ago :—" I send a bottle containing a number of small insects ; do you know what they are ? They were found by me on one of my cinchona *succirubra* fields. Being attracted by the peculiar appearance of the bark of one of the trees, I examined it closely, and found a narrow strip all round the stem about ½ inch from the ground, cracked, and apparently dried up. I gave the tree a pull, and to my surprise it snapped right through at the part mentioned, and the stump left in the ground was swarming with the insects referred to. I found that they had completely undermined the tree, as it were, by eating away all the wood, right across, leaving the bark only, which supported the tree ; they then had evidently made their way up the stem by eating out small passages. The insects evidently gained admittance underground, from the joints of the roots, which were in some places decayed, the roots themselves being perfectly healthy. I found

two of these trees close beside each other attacked with these insects. I have the end of stem and stump and roots of one of them; if you would like to see them I shall be glad to send them down." The insects referred to are identified by Mr. Staniforth Green as "white-ants of a very large kind." Our correspondent should try the effort of paraffin oil, on which another planter reported to us many months ago as follows:—"The trees that were manured with paraffin oil, in proportion of one wine glass full to a bucket of water, and about a measure applied to the trees, pouring a little round the stem and the rest round the roots, are showing *very favorably*. I am sure it keeps away the little black ants that support the black bug, if they do not bring it, and is obnoxious to the grub that feeds on the coffee roots."

TOBACCO.

INDIAN TOBACCO.

The cultivation of tobacco in India is one of the subjects that has recently been attracting attention, and there is good reason to hope that in a few years tobacco may occupy as prominent a position in our export list as do tea, coffee, and indigo at present. At Ghazipur on the Ganges, Government has established an experimental farm, 800 acres in extent, which, so far, is proving fairly successful. An American planter from Virginia has been employed to superintend the curing of the leaf when it comes into the factory. Mr. Caird during his Indian tour visited the farm, and was told that the soil is actually better than that of Virginia, and that the crop is much heavier, the American expert being of opinion that tobacco as good as the best Virginian growth may in a short time be produced in Bengal. It can be grown there at a cost of six pence per pound; it sells in India for the equivalent of two shillings, and as the produce per acre amounts to between 700 and 800 pounds, the profit yielded by the experiment is very satisfactory. Ghazipur tobacco is now well-known over the North-West as being as good, if not better, than most of the imported descriptions. Madras grown tobacco is irretrievably injured by careless curing and bad growing, but now that Government attention has been directed to the industry, it is to be hoped that in the Southern Presidency as well as in Bengal, some systematic attempt will be made to induce the ryot to bestow more care at least to the selection and growth of the plant. In addition to such care, all that is required is the establishment at suitable centres of one or two curing establishments under skilled superintendence with a system of money advances to the cultivator, similar to that under which opium is grown on Government account in Bengal. Australia is one of the markets which Indian tobacco ought to command. Indeed, even the present coarse cheroots would at once find a ready sale there were it not that the system under which the duties are collected brings "Trichis" under the same heading and the same charges as the finest manufactured Havannas. Calcutta already exports coarse unmanufactured tobacco to Spain and the South of Europe, and the trade in time will probably increase. Germany is one of the largest buyers of the weed in the world. Of the entire crop of 200,000 hogsheads of Kentucky tobacco, more than a half goes to the Vaterland, while the entire Maryland crop of 30,000 hogsheads goes to the same country as does one-half of that grown in Virginia.—*Bombay Gazette*.

TOBACCO IMPROVES THE SOIL.

I often read articles about tobacco impoverishing land. Now I wish to ask the question, does tobacco enrich land? In other words do farms increase in fertility by the raising of tobacco on them? I claim, Yes—by every successful farmer.

In the first place, to prove that it is exhaustive to the soil more than most other crops, is something more than to make the bare assertion. Give us the analysis of one ton of tobacco (1 acre) and 100 bushels of corn and 6 tons of stalks, or 40 bushels of oats and 2 tons of straw, or the average of any other crop per acre, and that will prove by theory which is the most exhaustive; but let us take a lesson from experience. Let us, for instance, take three pieces of land, enrich the same, put one to corn, one to oats, and one to tobacco. Then let us seed them down in the fall, and I think experience will prove that the grass after the tobacco plant will be much heavier and continue no longer than after the other crops.

I know, as far as my experience goes, there is no crop that leaves the land in as high a state of fertility as tobacco. I find the only trouble is that grain and grass are apt to grow too heavy upon it, but not so often Indian corn as oats. I suppose any heavy crop is exhaustive to the soil, but I think tobacco is the least so of any crop I can raise.

Does not the thorough cultivation that tobacco gets in midsummer draw from the atmosphere properties that you do not get from many other crops? I think farms about here are more productive than they were before tobacco was raised. I know on my own place I used to cut less than 15 tons of hay; now I average from 40 to 50. So with most of the tobacco raisers in this section; the products of the farms have increased some 50, some 60, and some an hundred fold. That is the way we are "exhausting" our land—by making two blades of grass grow where there used to be but one.

Certain it is that the raising of any crop successfully on the same piece of land would exhaust certain properties of the soil that that crop calls for; therefore I believe in a rotation of crops. An analysis of different crops per average yield per acre, would be very interesting as well as instructive to farmers. Is not some one prepared to give us the figures.—*N. E. Homestead*.

SERICULTURE.

SILK IN GURDASPORE.

A correspondent has furnished us with some interesting notes regarding the silk industry in the Gurdaspore district. This industry, he states, has declined somewhat since the lamented death of Mr. Halsey, and several persons who would have been silk-growers had that gentleman lived, have failed to keep silkworms for want of encouragement and help in the way of advances of eggs, money, &c. The present season has moreover been an unfavourable one; in some instances *all* the silk-worms of a silk-grower have died off, and the yield has not been generally more than half that of an average season. This mortality is ascribed by the natives to the effect of the winter drought on the leaves of the mulberry trees, but it is more probably due to the lateness of the season at which the eggs are hatched. The price obtained for the cocoons is about Rs. 80 per maund for unpierced cocoons, and at this rate there is a fair market; one native gentleman at Umritsur alone having, it is said, purchased Rs. 10,000 worth last year, and he has sent men into the district again this year to effect purchases. An agent of a Bradford firm has also been making pretty extensive purchases, and it is probable that he will buy the late Mr. Halsey's filature at Sujanpur, and rear silk-worms in the neighbourhood. The silk industry of the Gurdaspore and Kangra districts is one of considerable interest and importance; and at present, when it may be said to be languishing, every effort should be made by the local authorities to foster and increase it. The extensive purchases alluded to will, no doubt, have a good effect; probably much better than any system of cocoon exhibitions, and distributions of prizes would have produced, though it is understood that these will be continued.—*Pioneer*.

SILK-PRODUCING BOMBYCES.

Mr. Alfred Wailly has communicated some notes to the *Entomologist* on the reproduction of certain silk-producing bombyces in a state of confinement, which bear upon his communication printed in the *Journal* for June 6th last (p. 362):—

The two species—*Attacus Pernyi* and *Samia Cynthia*—pair very readily; but with most other species pairing is the exception rather than the rule. Why should *Pernyi* and *Cynthia* pair very readily in any situation, and most other species only accidentally? In a state of Nature certain species are reproduced to a far greater extent than others. When in a state of confinement the moths of exotic or even native species suffer from several causes—want of room, air, moisture, &c. With respect to native species, the cages containing the moths may be placed in the open air, and moisture may be supplied by watering the cages or placing wet sponges in them; but exotic species, if treated in the same manner, may have to suffer from another cause—the climatic difference between their native country and that of England, or any other northern country.

Hence the difficulty of obtaining fertile eggs, especially of exotic species, even supposing that male and female moths emerge simultaneously, which is not often the case unless a large number of pupæ be kept. In the middle of July I had at one time twelve fresh Atlas moths, male and female, three of which were of the giant race, yet I could not obtain a single pairing. Previously I had obtained a pairing with two of the smaller species of Atlas. With about fifty cocoons of *Pyri*, I only obtained three or four pairings.

Some persons think that if they have a few pupæ of one species they are certain to obtain fertile eggs. This is a great mistake, although the thing is not impossible. Now, with respect to the time and duration of the pairing of the species mentioned in my notes, *Promethea* moths I found to pair in the afternoon, or early in the evening; most other species, very much later. The pairing of *Yama-Maï* and *Promethea* is very short; that of *Pernyi* and *Cynthia* is of very long duration; that of *Cecropia* is long also. The pairing of *Polyphemus* with some moths is very short; with others, it lasts from about 10 or 11 o'clock in the evening till next morning. The pairing of my Atlas moths lasted from about 10 or 11 o'clock in the evening till seven o'clock P.M. of the following day. Of four pairings of *Actias Selene* two were of short duration, from about two o'clock in the morning till about five (three hours); the last two from the same time till about seven P.M. the following day. The average quantity of fertile eggs obtained from the four pairings was about the same from each female, the duration of the pairing having had no effect, that I could detect, upon the quality or quantity of fertile eggs; and it was the same with respect to the fertile eggs obtained from *Polyphemus*.

I have kept about forty pupæ of *Endromis versicolora*, with the object of obtaining fertile eggs. Only twenty moths emerged—seventeen males and three females. The first two females did not pair, the third female did pair for a considerable time, but died without laying a single egg. *E. versicolora* moths emerged from the beginning of March till the end of April.

Moths of *Attacus Roylei* all emerged from the 5th till the 20th of June; seven males made their appearance first. Subsequently I obtained seven fine females, which I placed with equally fine males in seven separate ages; but I regret to say I could not observe any of the couples *in coitu*. *A. Roylei* is a very wild species, resembling in shape and habits *B. Yama-Maï*. The eggs are similar, but somewhat larger than those of *B. Pernyi*.

From the fact of my having been unable to detect any pairing of *A. Roylei*, it does not follow that the eggs I have obtained will be sterile, the pairing taking place sometimes very early in the morning, as is the case with *Actias Selene*, and lasting but a very short time. I may, therefore, yet hope that many of the eggs will be fertile.

Of *Caligula Simla* I have just received twenty-four eggs, but only three larvæ have as yet hatched; these refused to eat chestnut and oak, and have died. The other eggs, which seem in good condition, will very likely hatch; if so, I intend trying other food-plants.

The long and severe winter we have had seems to have affected my pupæ of the different species of Lepidoptera, and has delayed the emergence of the moths for several weeks. In all probability it has caused the death of many of the early spring species, such as *Endromis versicolora*, *Aglia Tau*, *Attacus Spini*, and others.—*Society of Arts Journal*.

Registered No. 182.

THE INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA : SATURDAY, 1st NOVEMBER 1879. [No. 11.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS :

NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text, in parenthesis, or in a foot-note. The bigah *in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.*

CORRESPONDENCE.

THE SILK-WORM.

TO THE EDITOR.

SIR,—Though I have reared silk-worms now and again for the last ten years in the Punjab, I have never had an opportunity to try results from feeding with the China and Phillipine Island mulberry. As I have done so this year, I write the results. Though I had only two ounces of eggs, yet the greater part were addled, and I had not more than a few hundred worms, I however did not lose a single one from disease or otherwise. I hope next year to try the experiment on a much more extended scale, when I hope more facts will come to light as to failures from want of proper treatment and the disorders these creatures are subject to. I hear in Nurpur and other districts, and even in the Maharajah of Cashmere's territory, that a great number of worms had died, probably from bad treatment, *and* also from wanton destruction under the false notion of their being diseased. With proper ventilation, cleanliness, and a due regard to warmth and light (when the season is unusually rainy), I think success ought to be certain. I think the diseases attributed to constitutional degeneracy are exaggerated. I always tried the worms in their early age in baskets, and when half grown, transferred them to native *charpoys*, the excrements of the worms falling below, but the worms of themselves (when the leaf branches are piled on, so as to a admit ventilation) climb up to air and light, only going below when moulting. The feeding of worms from indigenous mulberry yields from seven to eight thousand cocoons to the seer; the yield from foreign mulberry feeding was 4,200 cocoons to the seer, so that the outturn was double. The cocoons are also well formed, large, and closed grained; there will be a yield of six ounces of reeled silk to the seer of cocoons. I have also for some years been experimenting on the wild silk-worms *Antheræa paphia*, which feeds on the "ber" tree. I hope before I have done to bring these under domestication: I have but paired them once, but next time I shall have eggs home reared. The silk from these is very good, but the cocoons require boiling for several hours before admitting of reeling. A solvent is needed, which I hope to arrive at. I find 624 dry cocoons of this Tussa make a seer. The moths will only couple at night, and they have to be put in a way so as not to feel confinement, but at the same time kept from straying away by flight.

Now that the shawl trade has lost public notice, and the Cashmerees have a poor prospect before them, it is much to be wished that more attention was given to sericulture so as to give employment to these people in British territories. They soon take to the industry.

W. J. B.

LEAF DISEASE AND THE DIFFERENCE BETWEEN MANURED AND UNMANURED COFFEE—A PRACTICAL QUESTION.

(To the Editor of the Ceylon Observer.)

SIR,—Coffee manured early in the south-west monsoon not only makes new wood, but the old branches exhibit grand and luxuriant foliage, and perhaps alongside unmanured coffee with any crop gets 'shuck' and covered with the red spores of leaf disease in its third stage. According to Mr. Morris, the disease enters the leaf and feeds therein in the wet weather, ripens and throws out the spores about this time of the year. Why does the disease *already in the leaf,* show in the unmanured coffee and not on the manured trees, although it must be present to the same extent in both? If there, it must come out whether the tree is manured or not.

PLANTER.

PRACTICAL HINTS ON CULTURE AND BARKING.

To the Editor of the Ceylon Observer.

SIR,—Your correspondent "A BELIEVER IN CINCHONA," writing under this heading, is, I have not a doubt, quite correct when he says there is not much fear of the produce of this small island ever glutting the market. I do not believe the present high prices will last, but if Ceylon sends good cured bark to the market, it will be many years before there is much reduction in its value.

The prices now secured for Ceylon bark should not be considered by a long way the maximum, for it is a fact that within the last nine or twelve months bark off what should not be called trees, but plants, finds its way to Colombo to be shipped. I have myself—and I know of a great many others—cut off the branches of one and two-year old plants which has fetched from 8*d.* to one shilling per lb. This pays, for the cost of securing the bark is very little. You send half-a-dozen coolies with knives to cut off two to four branches from each tree. At 4 o'clock they carry these to the store; next morning one woman will take the bark off all the twigs brought by the six coolies. There is no doubt that you get better trees and smooth stems by keeping the trees free of the heavy lower branches, and at the same time you get the bark of these twigs to sell. I have often thought lately that the very low price some shipments of bark have fetched might make people who intended investing in Cinchona think, the bark was not so valuable after all; but no one except the producers knows what rubbish has gone to the market to obtain only from 8*d.* to 1*s.* per lb. Large quantities of bark of this description finds it way into the London market; therefore the average price taken from present shipments can't be taken as a maximum, or anything approaching it, compared to what we should get when Ceylon sends bark to the market from a forest of trees five, six, and seven years old. Agents in Colombo should get from the owner a description of the bark they send from the estates. small twigs, about half the size of a pencil, are barked, and this is shipped home. Such bark cannot possibly contain more than a particle of the properties of quinine. Stem bark of a *Cinchona officinalis* tree two years old will sell for 3*s.* 6*d.* per lb. (I have secured this price), and the twigs of the same tree 10*d.* to 1*s*, these are good prices. At the same time I hope when the price of Ceylon bark is quoted again in your paper, you will be able to let us know how old the trees were, and whether they were half dead or alive! Many will not believe that as high as 2*s.* 6*d.* has been secured for bark from trees that have been pulled out by the roots (dead, to clear for supplying), and have been left *for months* in the hot sun and rain on the ground. You would fancy there was nothing in the dry stick; nevertheless it sold for the above price. At the same time I cannot help thinking these experiments will do a great deal of harm to this fine cinchona-growing island, unless the public are informed of the reason of these very low figures It rests with the agents to get the information. They should give such information to the public when it is their intention to publish account sales, if such account sales has cinchona quoted at from 8*d.* to 1*s.* the lb. no good stem bark either from *Officinalis* or *Succirubra* has ever fetched such a low price.

I have often thought of writing regarding the way cinchona clearings are planted. I am of opinion that *Officinalis* at first go-off are too close, 3 × 3, they should for the first two years or so be planted 6 × 6 or 5 × 5: the plants will have better stems. I should after two years plant in between, so that the last planting would come in for barking two years after the first: this gives time for good nurseries between the first and second planting. I think it is a pity cinchona planters still try to get trees from cuttings. How many are now alive of the millions of cuttings sold from Hakgala. I believe Hakgala sold between four and five million plants grown from cuttings between 1870 and 1875; had one-fourth of these lived, there would be fine clearings to be seen at present, are there any of all these plants alive? I think not! I feel sure this accounts for the large patches that have died, of which are referred to by your correspondent "ON THE HILLS."

QUININE.

THE DATE TREE.

TO THE EDITOR OF THE TIMES OF INDIA.

SIR,—"G. M. W." cannot be aware that the date has been thoroughly acclimatised in Sind for years past, and in most places, notably Roree, on the banks of the Indus, Upper Sind, grows to perfection. The fruit—fresh, moist, and dry—being equal to the best imported from Arabia. The natives have a tradition that the tree sprung up from the seeds of the dates consumed by the invading arms of Secunder (Alexander), dates as they allege, forming the principal portion of the food of that army.

The tree grows freely from the seed of both the indigenous and imported fruit, as also from shoots. This latter mode of culture is seldom resorted to, and only in the case of the rarer varieties, the general method being, when a zemindar takes up a new clearing, for him to give his labourers their midday meal of the finest dates he can procure, it being eaten and the seeds scattered as they follow their avocations.

The tree grows at the rate of about 18 inches a year, bears in seven or eight, the fruit improving with the age of the tree. The produce of the commoner descriptions sells on the tree at Roree at Rs. 3 per tree, while the finer sorts range from Rs. 4 to Rs. 6.

From the fact of the date tree being common to all Sind, but still coming to the greatest perfection at Roree, I conclude that it not only requires a very dry climate, but also a peculiar soil, such as that of the date groves at Roree,—loam and sand.

It is my opinion that south of Sind the date will never come to anything but the stunted *Saindooree* or toddy tree. I have, however, had some very fine dates off a tree in the compound of an Arab jemadar at Hydrabad, Deccan, but that tree, as far as I can learn, is the only one in the place.

Except now and again in Kurrachee, the date tree is never tapped for its juice.

SCINDEE.

Hydrabad, Deccan.

THE INDIAN OLIVE.

TO THE EDITOR OF THE MADRAS MAIL.

SIR,—As you were pleased to publish my letter regarding the wild olive tree of India, I write you a few lines if you think the subject worth a little more space. My reason for doing so is because the *Rangoon Gazette* still continues to urge the cultivation of this tree as a sure means of adding immensely to the revenue of British Burma, dealing out a sly backhanded rap at the officers of the Forest Department, simply because they have not found out the value of this tree, and by it added one more item of revenue to the insolvent exchequer of the Government, not thinking for a moment that these unfortunates cannot get labour enough for the legitimate work that they are bound to accomplish, and secure money enough even for that. But as "Devoes oil" from America sells cheaper in Rangoon than the crude earth-oil of this place, according to the *Gazette's* own showing in its issue of the 15th August 1877, so will the production and value of the olive-oil of Burma be to that of India, if the oil at any time should be manufactured largely for export to England and other markets. What, then, will be the benefit to Burma under such conditions? Of course capitalists are at liberty to invest anywhere, but is it not likely that they will take into account the immense difference of having to import labour from India at a ruinous cost, besides the prohibitory and penal conditions that the Government impose on employers of such labour, as compared with what they could do in India with the greatest ease, getting labourers just when wanted, and at a very moderate rate. India has an extensive network of roads and an immense amount of labour, and when Burma is able to stand on an equality with it in this respect, she may then strive to work out a source of revenue in undertakings of this sort. But when will that time come? An insolvent Government has taken to killing the goose in every hole and corner where one is to be found, so good-bye to golden eggs for a generation or two.

In the *Indian Agriculturist* of 1st August, a native correspondent enters very fully into the value and uses of all parts of the tree, though he acknowledges in the first instance, that he is not aware of anything like spirits being manufactured from the flower as stated by me. This he ought easily to be able to find out from neighbouring districts, and as the *Iupey* of the Tamils and the *mowah* of Bengal and Orissa are one and the same, he or anyone else will easily get a ready answer to any inquiry on this head. If the tree grows on the margin of a river in which there are fish, and you want sport there, sit on a branch hanging over the river when the tree is in flower, and you will see the fish rise up, open mouthed, to catch the flower as it goes spinning down from the tree. The water in the river at that time of the year is clear, so that the fish is able to see and be ready to rise open mouthed to catch the flower. At this time the "Cooracher," a person of the cultivating class in Wynaad, all of whom are splendid bowmen, may be seen seated on an overhanging branch, bow in hand, and the moment the fish is above the water, the arrow is sent into it; and when the man thinks he has enough, he comes down, and goes looking for the fish, which are easily found, as each arrow has a thin line tied to the end (of from 36 to 40 inches in length) a piece of *sola* pith being attached to the other end of the string, which acts as a buoy showing where the fish has cast anchor. The writer in the *Agriculturist* states that

the wood is yellow. I have seen the wood of this tree almost from one side of the triangle of the Madras Presidency to the other, as well as in Orissa and the N.-W. Provinces. When fresh it is pink, and of a mahogany colour at last. I have never seen it put to use by coach or cabinet-makers, or even by the village carpenters, while from its close and even texture one could carve splendidly on it. The writer states that to make the oil fit for culinary purposes, it must first be boiled in cow-dung, and after filtering through it, it is then fit for use. If this is the only way, I wonder to what extent the English public would patronise it, unless kept in as blissful a state of ignorance, as the curry-eating portion of Europeans and others are with regard to the manner in which the turmeric or saffron is treated before it gets into the market, the process being the boiling of the same in a watery mixture of cow-dung. This is used in all curries made in the Madras Presidency, as well as for all the preparations of the curry-powder manufactured for home and exportation. In Bengal the root does not undergo this process; they use the unboiled root, but to any one from Madras such curries have a strong nauseous flavour. It is only the paste of the raw sort that the belles of India rub over their bodies after bathing in river or tank, and it is only the unboiled root that the merchants ship to Europe.

In my previous letter I stated that France and Italy make two-thirds of their so-called olive-oil from the gingelly seed of India. Would it not then be better, or more profitable, to manufacture it in India to an equal standard, thereby finding more employment for the people, getting more value from such produce, and having the oil-cake for cattle or manure? There is no doubt but that the *illapey* oil would be most valuable also in the manufacture of soaps.

Rangoon. OBSERVER.

THE PALMYRA PALM.

SIR,—We have been asked if it is possible to ascertain the number of Palmyra palm trees within a radius of ten miles of Calcutta. Can you assist us?

MACKEWAN & CO.

Calcutta, 1st October, 1879.

THE KEEPING OF TEA.

SIR,—Will you kindly inform me whether tea, if packed in soldered sheet-lead cases, will deteriorate *if kept for any length of time?* Also, whether packing "tea in *tin*" does it any harm?

JOHN E. S. YOUNG.

Penshurst Peermerv, 30th September 1879.

REANA LUXURIANS.

SIR,—In your issue of 1st instant, a correspondent asks for seeds of the Teosinte (*Reana luxurians*). I have a large quantity for distribution—gratis—and will be happy to send a packet to any applicant. My seeds are from plants grown last year at Pennakonda, in Bellary district, from a few seeds obtained in Calcutta.

H. ROSS,
Madras Civil Service.

Gooty, 19th September 1879.

A NEW FIBRE.

SIR,—I am sending you by to-day's post a parcel containing samples of fibre prepared by me from a plant grown on this estate—

C sample is the fibre ready for the market unhatcheled.
A " " same fibre after hatcheling.
B " " tow taken out of A in hatcheling; it has not been whipped.

From experiments I find my fibre is stronger than that of Rhea, and for work under water I think it is unsurpassed. If you will take the trouble to *carefully* twist up a thread to size of No. B cotton, you will get a very fair idea of its strength.

I have sent samples to different parties in order to get some idea of its English value, and if the reports are favourable, I shall make a trial shipment of a ton or two; for paper, however, I do not consider it of any value, as I have failed to get the fibre into a pulp.

I shall be glad to hear your opinion of the fibre, and for a short notice of the fibre in your *Gazette*, if honestly you can write favourably of it.

I shall mention that the plant grows most kindly on my soil, and that the quantity I could supply is merely a question of capital. I am working some of the fibre up into cloth in a roughly-made loom, to see what it will do, for I am of opinion the fibre will be of value for mixing with other stuff for ladies' dresses, &c. I will try and send you a small sample of the cloth later on.

JAMES GEORGE BELLAIRS.

Chowkooree Tea Factory;
Almora, Kumaon, 14th Oct. 1879.

NOTE.—We shall be happy to show the fibre to any one.—ED., *I. A.*

KOTEGURH NOTES.

SIR,—The weather has been favourable during the past month. There was a slight fall of hail on the 20th; this, I believe, to be quite an unprecedented occurrence—or at all events, a very rare one—during this month. The rains may be said to have broken up about the time of the autumnal equinox,—*i.e.* the 23rd. The mornings are generally bright, though the afternoons are cloudy. However, there is sufficient sun to dry the grass after it has been cut, preparatory to its being made up into bundles and garnered, and to assist the millets and pulses to ripen.

The following is a comparative table of the past five seasons:—

	1875.	1876.	1877.	1878.	1879.
Haily days..	..	..	..	..	1
Rainy " ..	19	18	6	4	8
	Very wet month; ploughing, hay-making, &c., retarded.	Damp and moist; ploughing and hay-making retarded. Suitable for the millet & pulse crops	Dry. Hay abundant.	Dry; though not more than sufficiently so to carry off the excess moisture of previous month.	Favourable for ploughing and hay-making.

Light winds; slight thunder and lightening; bright mornings, cloudy afternoons; sun sets occasionally very beautiful; atmosphere brilliant and clear since the last third of the month; dewy mornings during the last week.

The thermometer (Fahrenheit) hung in an open verandah W. aspect; averages 62° in the morning, 67° in the evening—highest 70°, lowest 59°.

The spadix of the *Arum speciosum* is now a brilliant scarlet. The *chiretta* is in flower, and will be fit for gathering towards the end of the month, just before the seed arrives at maturity. A fine tall grass (vern. *Kash*) belonging to the *N. O. Cyperaceæ*—Sedge family—is in flower, the panicle presenting a very fine appearance; it grows in clumps, the stems reaching 6 to 7 feet high; some *Cyperaceæ* (the roots) are good for food, others are used as bitter and tonic remedies, others are aromatic; not having identified this one, I do not know what its use may be. Datura in flower at beginning of the month, fruit formed towards the end, ready for gathering next month; the seeds are used in asthmatic complaints, and the leaves are applied to boils and ulcers. An *Artimisia* (vern, *Chamberi*) is in flower; the juice from the leaves (they resemble those of the *Chrysanthemum*) is given to cure ear-ache; it must not be confounded with the *Kubush*, which, at a little distance, it resembles. Ground orchids and ferns in plenty, Michaelmas daisy in profusion.

Chakore are now beginning to come into the cultivated fields to pick up the seeds of grain.

Monkeys are on their autumnal tour, devastating the crops of the villages to a great extent. These animals pass up in spring and down in autumn, but whither they go in summer and winter no one knows.

Cocoons of a wild silk-worm (vern, *Targu*) are now found attached to stalks of grass and shrubs. The natives believe them to come from heaven, and to be the remains of shooting stars. No use is made of them here, but in neighbouring districts they are ground up and applied to sores.

The villagers are now busy giving their fields the first plouging for the autumn sowings, as they always like to turn up the earth once—at least fifteen to twenty days before they sow their seed—so as to let the atmosphere permeate the ground. When the seed is sown next month, then the fields receive their second ploughing. The wetness of the present season has retarded their operation this year, as ploughing cannot be done in wet ground, the earth afterwards becoming hard from the passing and repassing of the cattle and drivers. In every direction is heard the shout of the ploughmen encouraging their bullocks to continued activity, and the responsive grunts of the bullocks as their tails receive an extra twist, doubtless objecting to the whole proceedings. The villagers are also preparing their manure heaps, for which purpose they cut the leaves and young boughs of trees, mix them in alternate layers with their cattle manure, and in this manner double the manurial produce of their cattle; they like the rain to fall upon these heaps so as to wash the manurial properties into the leaves and young boughs to enable it to thoroughly ferment, and so make the whole

one beneficent mass for their fields. In their spare moments the villagers are also collecting their winter store of firewood, which they stack under the eaves of their houses, so as to have it handy when the snow is on the ground. Indian-corn (vern. *Chhalli, Kukri, Makki*), a millet; *Panicum miliaceum* (vern. *Chini*); and upland rice (vern. *Kaloh*, white kind; *Itura*, red kind) are now being harvested. The roofs of the villagers' huts are quite gay with a layer of Indian-corn spread out to dry before being threshed out; their appearance reminds one of the apricot season, when the apricots are also spread out in the same way to be dried before being stored for future consumption. Another crop, *Paspalum scrobiculatum* (vern. *Kodah, Kodra*) is nearly ripe; after a heavy shower the stalks fall over, and considerable loss to the villagers would ensue did they not take the earliest opportunity of straightening the stalks and binding them in sheaves of ten or a dozen together; in this manner they remain standing, and the grains can then ripen properly.

Grass is now being cut, dried, and stored for winter use; the hill haystack is nothing more than a collection of bundles 150 to 200 in number, piled round a pole about 15 feet high; the heap slopes upwards, and ends in one bundle stuck on the top of the pole. The grass is usually cut by women, who cut about sixteen bundles in a day; boys and men carry it away from 10 to 12 single handfuls (vern. *Muthee*), make a bundle (vern. *Pula*), and fifteen bundles make a cooly's load; it is sold at 120 to 130 bundles per rupee. The autumn harvest promises to be a very good one, so this will make up for the partial loss of the wheat and barley crops. Wheat and barley seed are very difficult to obtain, and the bunneahs and others are exacting high terms from such of the cultivators as are obliged to borrow. Food-grains are still dear,—wheat 7 seers per rupee ground, 8 seers unground; rice 5 seers table; 7 seers coarse; Indian-corn 10 seers ground, 12 seers unground.

We are fairly into the "*fall* of the leaf," apple and apricot trees are the first to shed their leaves, the colours of the former being dull brown, of the latter yellow and red, after them come horse chestnut and walnut, both with light-brown leaves.

One day in this month the natives hold a "bullock and cow festival," the bullocks have their horns ornamented with garlands of flowers, and receive a special allowance of salt, also some wheaten cakes; the cows have their foreheads anointed with oil, receive a special allowance of salt, also some wheaten cakes, but their horns are not ornamented with flowers. On the day of the festival the poorer villagers are fed at the expense of their richer brethren. The festival is actually the commencement of the operations for the autumnal ploughings and sowings.

The narcissus is in flower, unprecedently early. Jews' cherries (by some called Prince of Wales' chillies) in fruit; zinias, dwarf chrysanthemums, dahlias, petunias, dwarf petunias, asters, roses, fuschias, phlox, stoks, convolvulus, myrtle, mignonette, African marigolds, canary creeper, &c., &c., in great profusion. Tea plant in flower.

Potatoes are now being dug up owing to the spring drought, the out-turn and size much smaller than usual. Tomatos, cucumbers, pumpkins, beet, broad beans, peas, knol-khol, all yielding well. That giant pumpkin already alluded to, is in shape oblong, and measures 27 inches in its longest diameter and 24 inches in its shortest diameter; when it is weighed I will let you know the result.

G. P. P.

Kotegurh, September 30th, 1879.

P.S.—My brother-in-law, Mr. Ben. Rebsch, Oudh Forest Department, a capital shikari and ornithologist, who is up here on leave, has given me the following list of birds obtainable in this neighbourhood, all of which he has shot at different times on former visits. He has promised to amplify the list one of these days, when he can find the time to go through his collection of specimens:—

Ash-backed shrike.
Bulbul, black, Himalayan (*Hypsitetes psaroides*).
Brown-backed ground dove.
Black-throated laughing thrush.
Bunting, Himalayan (vern. *Khinch*).
Brown-fronted woodpecker (*Picus brunifrons*).
Crimson-headed black woodpecker—(higher ridges).
Caprimulcus asiaticus (Indian night jar).
Common night jar (*Capri indicus*).
Changeable white eagle.
Cuckoo.
Cuckoo, European (*Cuculus canorus*).
Cuckoo, Himalayan, pied.
Grass warbler } (In the valley).
Golden oriole }
Grey tree-warbler.
Great barbet (*Megilima virens*).
Great eagle-owl.
Gold-headed finch (*Metoponia pusilla*).
Hill tit (*Proparus chrysoenus*).
Hobby.
Lark finch.
Magpie, Himalayan.
Owlet, large barred (*Athene cuculoides*).
Pigmy owlet (*Glauca*).
Pigeon, white-bellied (col. *Cuconota*).
Rose-headed finch.
Robin magpie.
Rock pipit, Himalayan.
Roller (vern. *Nilkant*), in the Sutlej valley.
Red wattled plover.
Spotted forktail (vern. *Malti kilar.*) *Henicurus maculatus*.
Starling, Indian (in the autumn).
Sparrow hawk, Indian (in the valley.)
Tree-creeper, Himalayan.
Tit shrike.
Thrush, white-necked, laughing (winter bird).
 " Himalayan, spotted breasted.
 " Yellow-billed whistling (vern. *Kali Kilar*).
 " Streaked babbling (vern. *Bhakra*).
Wagtail.
Woodchat, white-breasted, blue (*Hypopicus hyperythenus*).
Woodcock (*Scolapax rusticula*).
Woodpecker, Rufous-bellied, pied (*Hypopicus hyperytherus*).
Woodpecker, scaly-breasted, green (*Gecinus squamunatus*).
Wood owl.
Wren, white-throated, Indian.
Fly-catcher, white browed, blue (*Musicapula superciliaris*).
 " Virditer.
Thrush, white-throated, laughing (*Garulax albgularis*), in winter.
 " plain-backed, mountain (*Crocinola mollistina*).

The Indian Agriculturist.

CALCUTTA, NOVEMBER 1st, 1879.

AGENCY FOR TEA COMPANIES.

It would be a thousand pities if the tea industry of India were to be smothered out of existence by difficulties being placed in its way. That there have been difficulties—aye and serious ones too—cannot be disputed. In the earlier stages of its existence up till now—for they are not yet removed—the industry has been cramped by oppressive measures of Government relating to the imported cooly. That grievance has been of such long standing that planters and owners have become quite accustomed to it, and would almost think that something were radically wanting if it were suddenly withdrawn. It is now, however, on the fair way of righting itself gradually, by means of the new opening to Assam, by help of the Northern Bengal State Railway, which will doubtless help the Darjeeling people too, when it has got into comfortable working order. The labour difficulty in Sylhet and Cachar is nearly at an end, as so many of the original coolies have settled down in those districts that what may now be called the local population has increased amazingly, and the introduction of the proposed railway to Mymensing, and which will certainly be continued to Cachar by way of Sylhet some day, will complete this deliverance. So far as the other tea districts are concerned, with the exception of Assam, the labour difficulty may be said not to have arisen. From time to time grievances have been prominently brought to the front, carefully aired, and quietly forgotten. Some of them may have been real, and perhaps as many imaginary, but there is one which has come to the front some short time ago, and is likely to remain there until it is adjusted in some way,—we refer to the cost of control generally. Enough has lately been said about the broker

and his *buying and selling* propensities, to permit us to press it for the moment, what we have to say will therefore refer more to the agency and directorate, although the broker may be indirectly brought into the discussion.

There can be no doubt that tea is passing through a crisis at the present moment. This crisis has been silently approaching for some years; we have seen it coming slowly on, but until lately we have done very little to avert it, perhaps because we have failed to appreciate those causes which were pushing it forward to its climax. That climax has almost been reached, and when passed will most probably lead to better days than ever for tea. But if no steps be taken to remove the causes of these recurring crises, we must make up our minds to face another in a few years, and now that competition is stronger than it was formerly, we may look for that prospective collapse at a shorter interval than prevailed between the last two. The first great crisis through which tea passed was from 1865 to 1868. Prior to the former date the industry was quite in its infancy, and the property of planters to a large extent consisted of young tea, on account of which the most extravagant notions of profit existed, which were used as a warrant for the indulgence of unlimited and utterly inexcusable expenditure. This coupled with a general want of experience on the part of all concerned, brought about the crisis referred to, a wiser experience was the result of that and the planting interest recommenced operations (in many cases) on a very much improved principle, a better class of managers was obtained, and considerably lower salaries prevailed, and from that point up till 1876 the tea industry steadily progressed, as will be seen from a glance at the following table :—per Rs. 100 paid up.—

	Dec. 1868.	Sept. 1870.	Oct. 1872.	Dec 1873.	April 1874.	Aug. 1875.	Oct. 1876.	Sept. 1879.
Assam Co., Ld. ...	75	100	205	200	200	200	350	350
Bengal Co., Ld. ...	60	50	69	84	87	97	82	58
Bisnath Co., Ld. ..	55	48	172	179	178	180	200	180
Dehing Co., Ld. ...	26	19	48	82	80	72	68	57
Debra Doon Co., Ld....	3	6	39	75	72	84	81	72
Durrung Co., Ld. ..	33	28	67	62	69	76	76	65
Eastern Cachar Co., Ld	75	105	145	146	160	185	135	101
East India Co., Ld. ...	18	25	75	70	78	85	76	57
Monacherra Co., Ld....	25	27	56	79	77	92	76	60
Muttuck Co., Ld ...	24	32	36	36	40	51	70	61
New Mutual Co., Ld. ..	107	200	423	410	507	800	790	533
Seom Co., Ld. ...	25	85	90	65	82	90	97	90
Averages...	44	56	119	124	136	168	168	139

The fall in value of shares since 1876 has not been so great as one would have been led to expect, simply because in spite of the low prices obtained for teas and the low dividends paid, shareholders were generally alive to the fact that these drawbacks were only temporary, and that their scrip was in the majority of cases a valuable property. Now with regard to the earlier crisis, we have seen what was the predisposing cause, we have also seen how that cause was removed, and how in consequence, tea again commenced an upward march; we are now at the turning point of another, and it behoves us to look for the cause of this as well. We have no hesitation in saying that the agent is at the bottom of it all, but we must not be supposed to be here impugning the honesty or competence of the agent personally, far from it; perhaps it might express our ideas on the subject better were we to use the term "system of agency." This is the cause of the evil, as we shall now endeavour to show. In the first place if the agent were all that could possibly be desired, he is not required in his present form. The manager on the garden has really the work to do, to him the shareholders have entrusted their interests, and in passing we have no hesitation in stating, as the result of a somewhat lengthened experience, that they could not entrust their concerns to better hands, as the tea manager is a gentleman who, as a rule, works hard for his employers' interest, and who is well worthy of the trust reposed in him. But it will be said that he cannot attend to certain work that can only be done in Calcutta; very true, and here an agent of *some* kind is necessary. As we write we have lying before us the annual reports of five companies, in whose accounts the agents' fees are separately recorded,—rather an unusual occurrence we may note in passing,—and from these it appears that large sums are paid for agency, for instance—

Bisnath Tea Co., Ld.	...	...	...Rs. 4,200
Durrung Tea Co., Ld.	...	.	... " 4,200
Indian Tea Cachar, Ld.	...	...	... " 4,000
Lebong Tea Co., Ld.	...	...	... " 6,000
Tukvar Tea Co., Ld.	...	...	... " 3,600

These sums divided by the number of lb. of tea made, shows that agency fees cost as near as may be four pies per lb., and this is the bare fee, and does not include the incidental charges and commissions. A note in a contemporary the other day mentions these as "2½ per cent. on the gross proceeds of the crop, 5 per cent. on purchases of stores, 10 per cent. interest on advances which are absolutely safe, 2½ per cent. on largest amount at debit, &c." Assuming these charges to be substantially correct, and we are not prepared to dispute them, shareholders will see what their agency costs them. When all these sums come to be examined,—we leave out meantime the interest on advances,—and when with this total the amount of Directors' fees is included, the grand total will be equal to about one anna per lb. on the tea made, and this be it noticed is a calculation concerning companies whose outturn is large; on smaller companies the system is simply ruinous, falling much heavier *pro rata*. It is no excuse for this state of affairs, that the agent frequently advances large sums of money to gardens; very true, but when they do so, they take exceedingly safe security, and charge interest in the usual way, so that need not be urged as an excuse. That is a banking transaction, and being complete in itself, there is no necessity for mixing it up with considerations of agency. There are other two points from which we can look at this expenditure. *First*, it absorbs ·566 per cent. of the dividend, and *second*, if the money so spent—the average of these five companies being Rs. 4,400 per annum—were utilized in extensions, it would suffice to plant from 20 to 25 acres of new tea every year, without any call on the shareholders being necessary.

The agents having no interest in the garden beyond the safety of whatever advances they may have made and their commissions, are perhaps quite unintentionally doing their best to destroy those properties. At the present moment the managers of gardens are not making the best teas they could make, they are not making the class of teas they *desire* to make, but they are largely manufacturing *rasping* teas to order; teas which are a burlesque on tea-making, and that are not by any means what the Indian article should be, but they are what the agents want. Mr. Baildon in his pamphlet "Tea in Assam," says (p. 7,) "Flavoury aromatic tea "is not wanted from India. Sufficient of this reaches the "home market from China almost every week. Good solid "strength is required in Indian teas, and if men who under- "stand their work, are put in charge of factories, I see no "reason why proprietors need fear the results of their "investments," and again (p. 35) "the old plan of 'panning' "is, I believe, a Chinese one, but planters in Assam are fast "giving it up. The reason for panning is to tone down the "harsh rough flavour of the tea, so as to make it mellow to "the palate. Now, as I said before, sufficient tasty aromatic "tea reaches the home market from China, without it being "necessary to increase the stock by importations from India, "considering that teas from this country are invariably used "for strengthening the China article, rough malty strength "is principally required, and if such is sent, no complaint

"will be made I fancy, unless indeed Indian tea is drunk "alone, and then a little panning is not out of place."

The author is evidently quite incapable of discerning the fact that in so writing he is, against his own convictions, recommending bad tea to be made. What he says really amounts to this, we don't want fine delicate teas, but strong pungent coarse sorts, that we may do what we can to help the China manufacturer to sell his weak insipid rubbish, and all this the agent sanctions, because he is too short-sighted to see ahead, and because the system secures him his commission in the meantime. In obedience to home dictation, these orders are sent up-country, and the bitter, pungent, rasping teas are sent to Calcutta to be forwarded to the London market for mixing with, and aiding the deficiency of, China teas, whereas it is an incontrovertible fact that if Indian teas are to succeed in creating for themselves a market at home, it must be by their being superior to the China teas in all respects. The public who like good tea, do not object to pay a fair price, but in paying this good price, they must have a good article. This will never happen while the bolstering up of China rubbish goes on. If the agents' commission were on the profits, and not on the gross outturn, he would very soon see this in its true light. And is there no remedy for all this, we have not thus probed the wound without having a remedy to propose. The disease is deeply rooted and has taken a strong grip of the constitution, and a drastic remedy is necessary. It will not do to modify its effects, the disease must be rooted out entirely, and we propose to attempt this.

We suggest then the complete abolition of the present system of agency, and that the Tea Companies, public and private, should be their own agents here. This, carried out literally, would be a manifest absurdity, as it would not pay for each garden to have a separate and independent agency. It must be done on the joint-stock principle. Let us take the Cachar and Sylhet district, and sketch out a plan to see how it would work. There is an annual production in these districts of about 12 millions of lb., but as many of the gardens are so bound up in the accounts of their agents, that they could not join any movement of this sort, we will suppose that one-half of the companies and private owners join. This would represent an annual produce of six million pounds which would pass through the agency's hands. Taking 80lb. to go to a chest on the average, we would thus have about 75,000 chests per annum. The agency would receive these. If instructions had been sent to have them sold here, arrangements would be made accordingly; if on the other hand they were to go to London, they would be carefully seen to, covered with gunny if such were ordered, and shipped according to instructions; if necessary they would be drawn against, and the amount passed to credit of, that particular company's account. If sold in Calcutta, the proceeds would of course be similarly treated. Thus the work would go on, and for this part of the work a very small establishment would be necessary. As during the busy season from ten to twelve thousand chests would be arriving at the Agency's Office *monthly, there is no* reason why the sales should not be conducted there, and by the Agency's officers. This of course might be an after consideration. Now let us look at stores. By the mere fact of the manager of the agency requiring such large supplies, he would be able to make the best arrangements as to quality and price, and on this item, and on that of the sale of tea, all agent's commissions should be *nil.* We come now to the keeping of the constituents' accounts. Well, that need not be such a difficult matter after all. There are some tea agents here who have about 200 gardens in their charge, and for each of these they must keep a separate account, and surely the agency could keep such as well. The accountant would keep a ledger account for each garden where all income and expenditure would be shown, all stores purchased being immediately debited, as well as all expenses incurred, while the proceeds of sales would be duly credited. Thus each garden would be charged actual *bonâ fide* charges, without a farthing of commission; at the end of each month a statement would be made up of such expenses as could not be charged to individual gardens, such as office rent, salaries of European and native establishment, &c., and this sum would be debited to each company's account in the proportion of the acres under tea represented by the company. These expenses need not exceed altogether the sum of Rs. 3,500 monthly, which sum would include all usually represented by "Secretary's allowance" as well as "Directors' fees," and would also embrace "Agents' commission," "commission on stores purchased," and everyting else in that line, and as it would be the monthly expenditure of property represented by about 30,000 acres, it would not amount to more than two annas per acre per month, or to look on it as a charge on each lb. of tea, it would amount to about one pie per lb. per annum, instead of one anna, as is entailed by the present arrangement. The total saving in that half of Cachar and Sylhet would be about Rs. 350,000 per annum,—a sum that may make all the difference in the world between profit and loss.

The only difficulty in the way is the directorate, which is an entirely useless appendage as at present conducted. We propose then that a joint directorate should be appointed for the purpose of controlling this agency principally, and would suggest that as many companies and gardens as possible should select the same gentleman here to represent them, as their director, to avoid making the board unwieldy, and that his duty will be to look after his company's interest in so far, that he will see to the shareholders' instructions being carried out by the manager and the agent. The united corporate directorate shall only work together in regulating the work of the agency, and in seeing that everything is economically carried out. They will appoint say three of their number to visit the agency regularly and confer with the manager. Their duty will also consist in examining all vouchers and in placing their initials against each entry thus vouched for in the separate accounts, so that when the independent auditor appears on the scene, he will only have a question of accounts to settle. It must be distinctly understood that these directors are not to be *nam-ke-waste*, but men who will really devote such portions of their time as may be required, to doing their duty by their several companies. To say that you could not get men to do this work unless they were very highly remunerated, is to brand mankind as utterly selfish, and if such an opinion is held, it is a powerful argument to the abolition of the present system of share directorates. The directors would meet on the agency premises.

This agency will require funds, doubtless a small sum will be necessary, but only to the extent of two or three months' expenses, and that should be, provided by the constituent members, and need not be a serious drain upon the funds of any company, By-and-bye as the system gets into working order, it might, and would be, advisable to establish a similar agency, on a smaller scale in London, when it should be the aim of the agency to sell teas to purchasers without the intervention of middlemen of any sort.

It may be said that this whole scheme is an interference with private trade, but there does not seem to be any objection to that, and besides these are times when it behoves the tea industry to make a mighty effort to recover itself from the slough of despond into which it has allowed itself to drift. Regarding the pecuniary connection which exists at present between the companies and their managing agents and secretaries, there does not seem much difficulty in the way of help-

of this kind being obtainable, when the security is good, without the borrower having to bind himself hand and foot to the lender, as is the case under present arrangements.

THE TRUE CAUSE OF AGRICULTURAL DISTRESS.

IN discussing Mr. Hope's Deccan Agriculturists' Relief Bill in a recent issue, we pointed out that the curse of the country is to be found in the rigorous and vigorous revenue system which makes it, a heinous offence on the part of the local officers to suggest suspensions or remissions in years of scarcity, not in the money-lender who enables the cultivator to tide over his difficulties. It is this system, we said, which turns scarcity into famine; which impoverishes the peasantry and depopulates the country; which is the great damning vice of British rule. If any proof of this were needed, it would be found abundantly in two recently published State papers—the Report on the Administration of the Bombay Presidency for 1877-78, and the Report of the Allahabad Board of Revenue on the Revenue Administration of the North-Western Provinces for the year ending 30th September 1878. Both Bombay and the North-West suffered severely from famine during the period, embraced in these reports. Yet the land revenue demand was rigorously exacted from the peasantry in both provinces. The considerations by which this harsh and unwise course of action was justified are explained in the reports mentioned above. In Bombay the total land revenue demand of the nine famine-stricken districts amounted to nearly a million and a half sterling; and almost the whole of this sum was collected. The remissions sanctioned by the Government amounted to £25,561, or less than 2 per cent. of the total demand. Sir Richard Temple thus defends his action in this matter :—

"The question of what should be the policy of Government with regard to this, the chief branch of the public revenue, was one which presented itself early in the famine. Leniency in one district, where the distress and injury suffered by the cultivators might have been really considerable, is well known to be the signal for those elsewhere, in places scarcely touched by the famine, to withhold payment of revenue, in the hope of obtaining a similar concession. It was clear, therefore, that Government, however generously disposed towards those really deserving of consideration, could not prudently hold out any hopes of remissions being given to these until the time for actually realising the early instalments, which fell due in January in most of the districts, had arrived. In the meantime the minute supervision and inspection of their charges by district officers had been the means of furnishing Government with detailed and trustworthy information regarding the condition of the landholders, and the real amount of damage sustained by them. *In some parts of the country this damage was very heavy; amounting virtually to the loss of the whole season's crop.* In other districts the failure had been only partial, *leaving, perhaps, enough for the subsistence of the occupant and his family.* Then, again, the previous condition of the agricultural classes in respect to solvency varied, as was remarked in an earlier portion of this chapter, in different districts, and with it their power to bear losses incident to their occupation. The assessment of the Government charge on the land is fixed according to the system in force in this presidency at a rate that makes allowance for any, but the extreme variations of the season, and on the principle that the charge should be such as will allow one harvest to balance another. There was also the further consideration that recent inquiries had shown Government that in a good part of the districts in which the failure occurred, the condition of the people was not such as to justify the belief that the abandonment of any part of the State demand would tend to alleviate the distress of the agricultural classes. Upon these considerations Government determined that revenue should be foregone to as small an amount as possible. Collections were ordered to be made as usual from all such as could pay, without pauperising themselves; the collection of the assessment due from persons who were merely temporarily embarrassed, was to be suspended for the season, and remission allowed only to such as were clearly unable to pay, either then or in future."

The italics in the above passage are ours. The extract is long, but we have thought fit to allow Sir Richard Temple to explain, in his own words, the considerations upon which the Bombay Government—with the previous sanction of the Government of India, of course—determined to exact the land revenue rigorously from the peasantry in the famine-stricken districts. Sir Richard himself admits that in some parts of the country the whole season's crop had been a total failure, and that in other parts, perhaps enough had been left for the subsistence of the cultivator and his family. Moreover, Sir Richard could not deny "the impoverished condition of the cultivating classes in the central portions of the famine area"—that is to say, the districts for which Mr. Hope's Deccan Agriculturists' Relief Bill is intended. Yet Government determined to forego revenue to as small an amount as possible. When this determination of Government became known to local officers, they naturally did not venture to recommend remissions and suspensions to any great extent, for fear of incurring its displeasure. District officers knew that heavy suspensions would lead ultimately to remissions, and they saw no ground to believe that remissions would be accepted by Government. There was, therefore, nothing for them but to do what was done—wring the uttermost farthing from the impoverished peasantry. That the collection of the land revenue greatly increased the sufferings of the people from the famine cannot be denied. It would be interesting to know what portion of the indebtedness of the peasantry in the districts of Poona, Sattara, Ahmednuggur, and Sholapore was caused by the merciless collection of the assessment during the late famine in Bombay. The cultivators who had enough left for the subsistence of themselves and their families, might, if the State landlord had not been so hard, have tided over their difficulties without resisting the money-lender. It is needless to say that the harsh course of action followed by Government, has involved the vast majority of cultivators in the famine-stricken districts of Bombay in hopeless embarrassments.

We next come to the North-Western Provinces. Sir George Couper, in reviewing the Report of the Allahabad Board of Revenue on the Revenue Administration of the North-Western Provinces for 1877-78, describes the character of the agricultural season of that year in these words :—

"The year 1877-78 was in every way a calamitous one for these provinces. *The kharif was generally a failure from drought.* A providential fall of rain in October 1877, enabled the cultivators to sow the *rabi* over an area much larger than is usually under cultivation in the cold season; but the untimely rain in the months from February to May developed rust and blight, which greatly diminished the produce: where the crops escaped blight, the grain was light owing to the prevalence of high hot winds: hail storms of unusual severity and extent did great damage in many villages, and much grain when collected on the threshing-floors was injured by damp."

In short, the net result of the agricultural season of 1877-78, to use the language of the Allahabad Board of Revenue, "was a general failure of the *kharif* crop, followed by an indifferent *rabi*." When the question of the realisation of the *kharif kists* first came before the local Government, Sir George Couper represented to the Government of India that the collection of the assessment, in the face of the total failure of the autumn crops, would "ruin the mass of revenue-payers." But the Supreme Government pointed out "that it would be a direct encouragement of unthrift if the demand were even to be suspended on any great scale"; and "the confident expectation was expressed that the great bulk of the autumn instalment would be collected at the ordinary season, and that suspension would be granted only in cases where they were absolutely necessary." It should not be forgotten that the letter from the Secretary to the Government of India, expressing those views, was written on the 4th of October—before "a providential fall of rain" in that month had secured the *rabi* sowings. The fate of the spring crops was indeed trembling in the balance when the Supreme Government expressed the confident expectation that the great bulk of the autumn instalment would be collected at the ordinary season." On receiving instructions from the Government of India, Sir George Couper addressed his famous letter of the 10th October 1877, to the Board of Revenue about suspension of the land revenue demand for the *kharif kists* in consequence of the failure of the crops. It was explained that "the demands on Government for funds are at times so pressing that it is impossible to authorise a general suspension, nor, great as the failure of crops in some

districts has been, is a measure of this sort imperatively called for." Sir George Couper directed "that zemindars who are well-off capitalists, who have other sources of income, and those whose tenants have saved a portion of their crops, and generally all who can pay up, should be required to do so. * * * * On the other hand, suspension must be granted to those who could not be made to pay up without reducing them to such straits as would render them unable to incur the necessary expenditure on the cultivation of their lands in the cold season." The Board of Revenue informed district officers that in view of the promise of a good spring harvest afforded by the late rains, proposals of remission of revenue would be premature; that "those landholders will be excused from the payment of the *kharif kists* at the prescribed dates, who can satisfy the Government demand only by recourse to the money-lender;" and that so much of the autumn instalment as would now be suspended should be wholly or in part satisfied from the profits of the *rabi*. Armed with these instructions, district officers, as might be expected, made every possible effort to realise the Government demand; and the consequence was that in the North-Western Provinces Rs. 1,85,00,000 was realised out of a total *kharif* demand of Rs. 2,14,90,000; and in Oudh Rs. 52,81,474 was collected out of a total demand of Rs. 65,21,480. The unrealised balances amounted to about 32½ lakhs. "The balances," remarks Sir George Couper, "represent the amount that was suspended." The Lieutenant-Governor is obliged to admit:—"*That much of the money paid into the State treasury by landlords was borrowed from money-lenders; the great increase in the number of documents registered would tend to show, and probably the difficulty of tiding over the hard times in the cold weather of* 1877-78 *was aggravated.*" Yet the Board of Revenue had distinctly told district officers that "*those landholders will be excused from the payment of the kharif kists at the prescribed dates who can satisfy the Government demand only by recourse to the money-lender.*" Mr. Auckland Colvin, late Collector of Bijnour, and now in the service of the Khedive of Egypt, says that in spite of the relief afforded by the suspension of half of the *kharif* demand in his district, "money had to be borrowed on a large scale at a high rate of interest, and much jewellery was sold or pawned. Registered deeds show a very heavy increase, and so do transfers of property. A calamity such as that of 1877-78, partial though it was, guts a district. Embarrassments have been renewed or created, which in too many cases will never be cleared off. Add to this the mortality and the emigration, and we shall find, as the famine clears away, a population reduced, greatly impoverished, disheartened, and dislocated; a proprietary loaded with fresh debt; and, eventually, an increase in the transfer of land from the agricultural to the non-agricultural class. That is our present aspect and prospect. Suspension of land revenue lessens the distress, but can only mitigate it." It is impossible to express in stronger words than these the mischief caused by the rigorous collection of the *kharif kist* in the North-Western Provinces in 1877-78.

The benefit of remissions in cases of destruction of crops is unquestionable. We should certainly hear less of the money-lender if our revenue system were not so rigid. As the law now stands, consideration is shown only when exceptional calamities affect particular tracts. When the crops have been destroyed by hail or floods, and the cultivators are threatened with ruin, prompt action is taken under section 23 of Act XVIII of 1873. In such cases a remission of revenue is granted; and the landholder thus relieved is made to give similar relief to his tenants. But the principle embodied in section 23 of Act XVIII of 1873 cannot be applied where the crops have failed from drought. This distinction is altogether illogical and invidious. The difference in the manner of the ruin of the cultivator should not stand in the way of granting him relief. If his rents are forgiven when his crops have been destroyed by hail or floods, there is no reason why a similar consideration should not be shown to him when his crops have failed from drought. The question is a most important one. The condition of the agricultural class in India cannot be improved without making material alterations in our entire system of land revenue, as regards both assessment and collection.—*Statesman.*

PHOSPHATIC MANURES.

PHOSPHATES in some form or other are invariably present in greater or less abundance in every soil capable of profitable cultivation. The source whence they are derived is of course the rocks forming the earth's crust broken up, disintegrated and scattered, by the physical, chemical, and vital agencies unceasingly at work. Phosphates occur in small quantities in granite, gneiss, mica-slate, and other metamorphic rocks. The surface layers of lead ores have frequently a deposit of phosphate of lead (*green lead ore*). The fractured and other surfaces of clay-slate are often overlaid with phosphate of alumina. It is present in varying quantities in limestone. *Apatite*, a mineral phosphate of lime, is found in great abundance in Sombrero, Navassa, and Aruba, in the Carribean Sea, and in St. Martin in the West Indies. In Norway it occurs in the fissures of syenitic granite. Coprolites, the fossil bones and dung of extinct animals, contain a large percentage of phosphates, and are quarried for agricultural purposes in several parts of England, France, and South Carolina. These rocks formed into soil, supply phosphates to plants. Plants store them up in their seeds in large quantities. Animals which feed on these seeds and other parts of plants gather up in their bodies large quantities of phosphates, chiefly in the bones. Phosphorous is also an essential ingredient of brain and nerve tissue, and it is discharged from the system in a soluble form in the urine, and in an insoluble in the solid excrements; hence the value of *guano* which is the solid excrements of sea birds accumulated for years, and subjected to more or less weathering influences in almost rainless districts. There is a perceptible increase of phosphorous in the urine of a man who has much brain-work, compared with one whose tissues are used up in manual labour. Here is another instance of "the great round of Nature." Physical science knows nothing of annihilation, nothing of loss; the very sun-beams of the geologic past are stored up in coal to brighten and warm the winter darkness of to-day, and to feed the machinery, by means of which man is changing the face of the world, and harnessing the forces of Nature to the "Triumph Car" of civilization.

The two chief sources of phosphates for agricultural purposes are the bones of animals and the mineral phosphates already enumerated.

Bones came first into general use when attention had been called to their marked effects on the exhausted pasture lands of Cheshire. Lands used for feeding cattle for many years could not fail in the end to be all but drained of their soluble phosphates. The phosphates contained in the milk, and in the building up of the bony frame-work of young animals were carried off the land; and only a fractional part returned in their dung. It has been estimated that about a pound of phosphate of lime is contained in from 25 to 30 gallons of milk, and the drain on land every year for each cow is about 80 pounds of bone. The effect of the application of bones to land rendered almost sterile by a process of this sort, was very marked. Bones were first employed in the form of "half inch bones,"—that is, they were broken in pieces sufficiently small to pass through a seive with meshes half an inch square. In order to shorten the interval between the application of bones and their effect on the soil, the bones were further reduced in size and applied as bone-dust. Still further to hasten their action on land deficient in phosphorus, bones were fermented,—that is, half inch bones were placed in a heap, moistened with water, and excluded from contact with the air by covering them up with earth or saw-dust. In eight or ten days they had become softened, and when applied to land, speedily became friable, and in this way were more intimately mingled with the soil. The chemical changes that took place in this process of fermentation we shall notice presently. This method of applying bones continued up to the year 1840.

In that year, Liebig at a meeting of the British Association, made public his method of treating bones with sulphuric acid, by means of which the phosphates contained in bone were rendered immediately available for plant-food, without waiting for the slow action of the carbon dioxide in soils to render them soluble. Thomas Proctor of Bristol was present at the meeting, and heard Liebig unfold his method and discovery. Proctor got to Bristol with all haste, and began the manufacture of what has since been known as super-phosphate of lime.

* The bones chiefly used for the manufacture of soluble phosphates are those of cattle and sheep; horse bones are also employed. When bones are genuine, their composition and quality do not differ much.

From this analysis of the late Professor Anderson of Glasgow, it appears that about *half* the weight of bone consists of phosphate of lime, and that, generally speaking, the remaining half is made up of organic matter (*gelatine*), yielding chiefly ammonia and carbon dioxide and water. When the organic matter has been removed by burning or boiling, the residue contains from 70 to 80 per cent. of phosphate of lime.

Composition of fresh bones.

Water	6·20
Organic matter* ...	39·18
Phosphate of lime	48·95
Lime	2·37
Magnesia	0.80
Sulphuric acid ...	2·55
Silica	·30
	100·

* The organic matter yields about 4·80 per cent. of ammonia.

When land is manured with bones, the changes that take place, shortly stated, are as follows: The carbon dioxide—one of the constant products of decay and disintegration, always being liberated in the soil and carried down through it in rain water—acts on the lime phosphate of the bone, and produces calcic carbonate ($Ca\,CO_3$.) and bi-calcic phosphate ($Ca_2\,H_2\,P_2\,O_8$). The phosphate contained in bone is a tri-calcic one, and the action of carbon-dioxide on it may be thus illustrated—

$$\left.\begin{matrix}\text{Tri-calcic}\\\text{phosphate}\end{matrix}\right\} + \left\{\begin{matrix}\text{Carbon}\\\text{dioxide}\end{matrix}\right\} + \text{Water} = \left\{\begin{matrix}\text{Bi-calcic}\\\text{phosphate}\end{matrix}\right\} + \left\{\begin{matrix}\text{Calcic car-}\\\text{bonate.}\end{matrix}\right.$$

$$Ca_3\,P_2\,O_8 + CO_2 + H_2O = C_2\,H_2\,P_2\,O_8 + Ca\,CO_3$$

The formation of this bi-calcic phosphate in the soil is a matter of slow accomplishment, and when produced, it is rendered gradually soluble in water by the further action of carbon dioxide, and so carried into the tissues of growing plants to build up their structure. The interval of time between the application of bone and the slow action of the carbon dioxide and water contained in the soil, was a period extending from a few months, to perhaps years, and depended on the form in which bones were applied, half-inch, bone-dust, or fermented; and the vigour with which the natural agents acted on them. The practical usefulness of Liebig's discovery consisted in this, that by making use of a stronger agent, sulphuric acid, instead of Nature's agent, carbon dioxide, the solubility of bone phosphates could be effected at once, without waiting for the tedious action of Nature's forces. In addition to this, the phosphate produced was readily soluble in water, and was at the moment of its application to the soil available as plant-food. The reaction may be illustrated by the following equation.—

$$\left.\begin{matrix}\text{Tri calcic}\\\text{phosphate}\end{matrix}\right\} + \left\{\begin{matrix}\text{Sulphuric}\\\text{acid}\end{matrix}\right\} = \left\{\begin{matrix}\text{Mono-calcic}\\\text{phosphate}\end{matrix}\right\} + \text{Calcic sulphate.}$$

$$C_3\,P_2\,O_8 + 2\,H_2\,SO_4 = Ca\,H_4\,P_2\,O_8 + 2\,Ca\,S\,O_4$$

That is, instead of an insoluble phosphate containing *three* equivalents of lime slowly acted on by carbon dioxide, a highly soluble phosphate containing one equivalent only—the other two being replaced by water—was produced almost at once. Two years after Liebig's discovery, 1842, J. B. Lawes was able to demonstrate that this same readily soluble mono-calcic phosphate obtained from bones, and hitherto solely manufactured from them, could be obtained from minerals containing phosphate of lime. This was known by the name of mineral super-phosphate to distinguish it from super-phosphate manufactured from bones alone. At the present day super-phosphates of lime are largely manufactured, which contain a mixture of these two phosphates, animal (bone) and mineral. In a mixture of this sort, the cost of production, and hence the market price of phosphates is considerably reduced, while their value as plant-foods are of a very high character. Indeed, on certain soils and under certain conditions, probably better results may be obtained from a mineral super-phosphate, than from a more costly bone super-phosphate. It should be noted that super-phosphates manufactured from bone,—known in the market as dissolved bone,—always contain a variable percentage of ammonia, from one and a half to two per cent. This percentage of ammonia is derived from the *gelatine* of the bone. Bone ash, burned bone, the refuse of sugar refineries and soap works, have nearly all the organic matter burned out of them; and when employed, in the manufacture of super-phosphates of lime, can yield only traces of ammonia on analysis, unless it has been added in the process of manufacturing. The presence of gelatine in raw bone hinders the action of the sulphuric acid, and produces a pasty mass little suited for scattering of any [illegible] as dissolved bones is usual [illegible] bone-ash or coprolites [illegible] bone-meal or ground bones, an[d] the mixture treated with sulphuric acid. In 1860 the value o[f] dissolved bones ranged from £4 to £5 per ton. In July of the present year, the market value of dissolved bones was £5-15 per ton, *while that of super-phosphate of lime was £4-4 per ton. In the same month, crushed bones brought as high a price as* £5-16, and whole bones £3; *while Cambridge coprolites, now used* largely in the manufacture of mineral super-*phosphates, sold as* high as £12 per ton, while Peruvian guano direct from the importers' stores sold at £12-5.

On light sandy soils, where it is desirable to add phosphates, bone is the most economical form in which to apply it. In this way the phosphate contained in the bone is slowly liberated and used up gradually by the crops. Were phosphates added in a highly soluble form, the first heavy rains would wash them out of the soil into the drains and thus produce great loss. Where lime is present, even in comparative small quantities, the highly soluble phosphate applied in the manufactured manure is gradually changed into the less soluble form produced by the natural action of water and carbon dioxide on bones. The phosphates are thus retained a longer time in the soil; they cannot be so readily washed out by rains, and as a consequence their good effects are spread over a longer period.

The belief that phosphates are being over-manufactured,—that is, as high a percentage of soluble phosphates are produced as the materials employed are capable of producing,—has found expression on more than one occasion. The conversion of the phosphates by means of sulphuric acid (Liebig's process), into highly soluble mono-calcic phosphate, does not only, as we have already noticed, render them liable to being washed out of the soil before they have in any perceptible degree influenced the crop; but it has been observed that the character of the vegetation, under certain conditions, is of a less healthy description than that invariably produced by the slow disintegration of bone under the milder influences of natural agencies. It has been pointed out by Professor Tanner, that the bi-calcic phosphate produced by the forces of Nature on decomposing bones in the soil may be produced artificially by employing one-half the quantity only of sulphuric acid, at present used to produce the highly soluble mono-calcic phosphate. This latter phosphate, for the reasons already shortly noticed, is believed, all things considered, to be the most desirable. Manufactured phosphates that have stood for some time, are frequently found to have changed in character to this extent, that the same sample which at first analysis yielded 25 per cent. soluble phosphate, will latterly give only perhaps 20 per cent. This seeming deterioration is due to the fact that, owing to the presence of bone-dust, some of the soluble mono-calcic phosphate has parted with one of its equivalents of water, and taken up from the finely pulverized bone a corresponding equivalent of lime, thus increasing the bi-calcic, and diminishing the mono-calcic, phosphate. Now, as chemists have hitherto calculated the values of super-phosphates on the amount of soluble phosphate only, the *chemists'* value of such a changed phosphate would be less and less, as the mono-calcic phosphate disappeared and the bi-calcic increased. It is a fact capable, we think, of demonstration, that such *reduced* super-phosphates as they are called, are in reality of more value as plant-foods, and better suited as fertilizers than the original unreduced manure; they are more lasting,—that is, their effects are spread over a longer interval, and there is less likelihood of their disappearing from the soil after heavy rain.

The method of estimating and selling manures by what is called the *unit system*, is probably as fair a one as could be devised, and is in pretty general use. We believe with Mr. Tattlock, F.C.S., that "it does not come within an analytic chemist's province to fix the money value of the article which he analysis." We reproduced his letter in the June number of our issue, page 185. With the distinction between price and value we shall not be tempted at present to enter. Manures, like every other marketable commodity, are subject to the fluctuations of supply and demand; and it may be sufficient for our present purpose if we define price as the *money* value of a commodity agreed on in open market between buyer and seller. The analytic chemist may, and very effectively does, point out what substances in manures are *valuable* to the agriculturist, their *price* can only be fixed fairly in the open market.

In phosphatic manure, the substances valuable to the agriculturist are the phosphates—soluble and insoluble—and the ammonia. Whatever other substances may be present are left out of reckoning in estimating the price of the article. The percentage in which the substances are present materially affects the price, and the unit system now in pretty general use consists in this, that phosphates, &c., are bought and sold at a rate per unit agreed on by buyer and seller. For instance, if a phosphate contain 25 per cent. soluble, 10 per cent. insoluble, and say 2 per cent. of ammonia, then the price per unit per ton of each of these is a matter of constant fluctuation, according to the state of the market.

If soluble phosphate were sold at 5 per cent. a unit, then the price of 25 per cent. would be 25×5=£6-5 per ton. If ammonia sold at £1 per unit, then in the case given the price of 2 per cent., that is, £2 would require to be added, and so with the insoluble phosphate whether bi-calcic or tri-calcic.

Phosphatic guano, or phospho-guano, has been offered in the market as a substitute for guano. In reality it is not guano at all, but a highly concentrated super-phosphate containing about 26 per cent. of bi-calcic phosphate, and about 4 per cent. of ammonia, the other bulkiest factor being sulphate of lime,—calcic sulphate. All plants require phosphates, but all soils do not yield them in like proportions. The clay soils of Suffolk, though at one time under dairy farms, are still rich in phosp hates, and the application of bone to these lands produces little effect on their fertility. All perennial plants, such as grasses, owing to their well-developed roots, are able to draw from a large mass of soil sufficient phosphates and other plant-foods, at the very beginning of the "growing season." Grass-lands can be improved by the application of bones, only when there is a deficiency of phosphates in the soil. Land may be unproductive because of the absence of other plant-foods, which may be essential for the building up of certain crops. Phosphates applied in this case would be followed by no appreciable gain in fertility, until the deficient plant-foods were supplied. If deficiency of phosphates is the cause of decreased productiveness in grass-lands, the application of calcine or crushed bones will have a speedy effect on the weight and quality of the crops. It is in their application to "root" crops, and notably turnips, that phosphates have produced some of their most marked effects. The seed of the turnip is a small one, and it is put into the soil at that season of the year in Britain when the heat is greatest and growth is most rapid. If the rootlets do not at once meet with a concentrated supply of phosphates, however abundant the other plant-foods may be, the plants will not be able to assimilate them with that rapidity which will carry the crop beyond the stage when it is most liable to attacks of insects, and ultimately insure a heavy crop. The usual method of applying phosphates to turnips is one-half with the seed, and the other half after "thinning."

The wide appliciation of phosphates as manures, and the importance which their manufacture is assuming as a branch of industry, may be gathered from the fact, that the yearly outlay on these manures alone has been recently estimated in Britain to amount to nearly three millions sterling.

AGRICULTURE TEACHING FOR INDIA.

IT has become fashionable in certain quarters to pooh-pooh and sneer at much of the earnest work that has been attempted here in India for the advancement of agriculture.

Some men are supposed to be born with a set of ideas which seems to serve their turn till the end of their lives' chapter, without the trouble of any further additions. Other men have their ideas put into them with the morning paper, they are always found echoing the popular or fashionable creed, whatever it may be; and have a marked facility of agreeing with the last speaker. Those who care to think for themselves, and have the hardihood to ruffle the self-complacency of their fellows, by suggesting that such and such a scheme might be followed out with advantage, are met with all sorts of objections, such as, "You can't do it, it is not in accordance with the established order of things here;" "it is not enjoined in Scripture; it will never succeed; it will produce ruin and anarchy." Then, after perhaps some measure of success has followed the reprobated scheme, its very detractors and opponents will turn round and say, "There is nothing new in it; it is as old as the hills." "I knew it would succeed; I told you so." Here in India the advocating of improved methods of agriculture is looked on with considerable indifference; and the ideas and plans of the advocates are sometimes treated with but scant courtesy.

The amount of ignorance and self-conceit which pass current for knowledge and experience on things agricultural amongst certain Indian officials and others, who are supposed to have had the training and education of gentlemen, is a sure indication that whatever improvements may ultimately be brought about in Indian agriculture, will have to be accomplished not only in the face of the *vis inertia* of the ryot and his hard down-trodden lot in life; but in spite of the glib talking and authoritative tone of men who at some period of their career have come in contact with the results of some imperfectly performed experiment; and whose opinion regarding the case in point is of less value, even than the ryot who told the experimenter that Europeans could not teach Indians agriculture, that in fact the teaching power was all the other way.

There are men in India who will grandly tell you that the cure for India's agricultural ills can be stated in one word—"water." They say irrigate the country, then famines will disappear, and "halcyon" days of prosperity and plenty will be the lot of India. Hydrophobites are not so pertinaciously self-assertive recently, perhaps, as they have been. Irrigation no doubt is useful; it has in years of deficient rainfall proved a blessing; and where irrigation canals follow and connect the great natural lines of water-drainage and the water is suitable for the crops, they may, in the long run, prove profitable investments commercially; but it has been shown by the head of the lately abolished "etcetera" department that the injudicious use of water produces more mischief to the land than the want of it. The copious application of water to land no doubt increases the outcome of crop for a time; but unless provision is made to return to the soil the plant-foods taken from it in more than usually heavy crops, the last state of that soil will be worst than the first. The truth seems to be that there is no *one* panacea for the agricultural ills of India. Schemes of improvement may follow many seemingly divergent lines which nevertheless may all tend in the same general direction.

We have on more occasions than one in these columns advocated the establishment of Agricultural Colleges in Bengal and other parts of India. The principles that underlie the science of agriculture are of universal application, and are imperatively necessary to be known and understood by those who would be successful cultivators, in any part of the earth's surface, whether the climate be temperate or torrid, and no matter what the crops may be. Here in India, where many millions of lives depend directly on the products of the soil, and where the failure of a single year's crop produces widespread, unspeakable misery, and the loss of millions of lives, it seems to us that one of the most urgent duties of the Government is, by every means at its disposal, to scatter widely over the land information of a suitably simple and accurate description, which in any way may tend to build up more rational ideas regarding the soil and its treatment. Information of this sort it seems to us should find its way not only into every primary school, in some such form as that of the "First Lesson in the Science of Agriculture, issued under the authority of the Department of Agriculture and Commerce, N.-W. Provinces and Oudh"; but a judiciously arranged system of scholarship, connecting the primary schools with the "Model Farms" of the district, and these again with the Agricultural Colleges of the presidencies, would secure that the likeliest lads in every district who would avail themselves of these scholarships, would be thoroughly embued with ideas and methods of a perfectly practical character, which they would carry back with them to the occupation of their fathers, and in time reproduce in their own practice.

It is not at all necessary that the agricultural training should be carried on to that point where the student should be taught to analyse soils, manures, and feeding stuffs, or even that "Model Farms" should have a well appointed laboratory. It appears to us, however, that the fundamental principles underlying all rational

treatment of the soil, should be unceasingly and continually reiterated and repeated in the primary school, and the Model Farm and the Agricultural College, and that side by side with theory, the practice should as unceasingly be exhibited of those methods, improvements, and results, which tend most to the improvement and development of the resources and products of the soil, and the wealth of the cultivator.

THE SCIENCE OF AGRICULTURE.

Communicated.

IT is now, we suppose, universally admitted that agriculture, in order to be progressive and profitable, must be conducted on scientific principles. To attain this end, and to meet the demands of an increasing population, the United States Government has for a long time included a Department of Agriculture, the main object of which is "the introduction of all the productions of the earth that can be grown in any part of the country, and to encourage by every means that diversity of production which is at once the safety and the wealth of the nation." From the Prefatory Report of the Commissioner of Agriculture for 1878, we learn that experiments were made during last season on the growth of different varieties of sugarcane. As far as the experiments go, a variety of cane from Jamaica, called the *Salangore*, is shown to be worthy of extensive introduction and trial. The attention of the Commissioner has, however, of late been more especially given to the question of producing large supplies of sugar from sorghum and maize. He procured as much as possible of the pure well-cured seed of a variety of sorghum called the "Minnesota Early Amber," and distributed the same in every Congressional district in the United States. The results of this distribution have been most favourable, and the variety has yielded everywhere a large amount of rich saccharine juice, which, under proper treatment, gives excellent sugar and syrup, the yield being from 120 to 250 gallons of heavy syrup to the acre. It is proposed another season to make experiments with the different varieties of maize and sorghum, and to ascertain the different modes of cultivation, and the stage of growth at which the production of sugar is at its maximum, in order that with as little delay as possible the country may be prepared with all necessary data to enter intelligently upon this new industry.

The great drawback to the work of the department seems to be the want of a larger chemical laboratory, with a sufficient appropriation to meet the expense of the additional force that will be necessary to carry forward investigations on a larger scale than the present laboratory and appliances will permit. With the facilities of the existing laboratory much information which skilful chemical analysis can only determine is, remarks the Commissioner, necessarily withheld from the farmer and the manufacturer. The report contains extracts from letters from prominent agriculturists in the United States, all of whom testify to the fact that the agricultural interests of the country would be greatly advanced by a more thorough analysis than has yet been made of the grains, grasses, and edible roots, in order to determine the exact value of each in the production of milk, beef, and fibre or muscular power.

The English Government would do well to follow the lead of the American Government, by establishing experimental agricultural stations in various parts of the kingdom, with properly furnished laboratories and experienced chemists. It is impossible to overestimate the benefits to agriculture in England resulting from the scientific experiments made on a large practical scale by Messrs. Lawes and Gilbert at Rothamstead, but we contend that such work ought not be left entirely to private enterprise.

In the preface to the English translation of his Lectures on Chemical Manures at the Experimental Field at Vincennes, M. Georges Ville remarks, that it is important that both England and France should be alive to the fact that the agricultural crisis from which both countries are now suffering, as well as the more serious troubles which threaten civilised nations, are only the prelude to the economic struggle between the Old World, bound in the trammels of tradition, and the New World, pressing onward free and unrestrained in the path of progress.

At a period when the means of communication had not reached the development which they have since acquired, the home markets provided certain and easy outlets for agricultural produce. But at the present time, with free trade and the facilities of transport, farmers are compelled to compete in our own markets with all the world. In order that the struggle may be possible and remunerative, it is absolutely necessary that crops of every kind should be increased to their utmost possible limit. The traditions of the past are not sufficient for the necessities of the present. We want more rapid, more economical, and more powerful processes. The agriculturist used to divide the land into two nearly equal parts, setting one aside for grazing purposes, or for growing forage plants, and reserving the other for cereal crops, which was equal to asserting that in order to grow cereals, there must be meadow land, cattle, and manure.

The object of the farmer, then, should be not to produce manure, but to manure his land more abundantly than formerly. No matter what may be the material he employs, whether it may be farmyard or chemical manures, used either together or separately, he must somehow or other give back to the soil a larger amount of fertilising material than that lost by the growth of the crops. In the cultivation of the soil, increase of production depends less on the worker and on the quality of the tools which he employs, than upon the quantity of fertilising materials which he has at his disposal. According to M. Ville the only way to do this is to employ chemical manures, and to prove his assertion, to show that with chemical manures large crops may be quickly obtained from the most barren lands, he refers among others to an experiment carried out by M. Ponsard, President of the Agricultural Committee of Omey in Champagne, on a piece of waste land in one of the most barren districts of a proverbially barren portion of that province. M. Ponsard manured one-half of the ground with about 32 tons of farmyard manure per acre, and the other with about half a ton of chemical per acre. With the farm manure he obtained 14 bushels of wheat, whereas with chemical manure the land yielded about 30 bushels, there being a loss of £19 in the former case, and again of £17 in the latter.

Similar experiments have been made with beet-root, potatoes, sugarcane, &c., and in each case the results have been in favour of the chemical manure. In fact, by varying the quantity of the ingredients entering into the composition of chemical manure, so as to suit the requirements of each class of plants, the work of vegetation may be regulated almost like a machine, the usefulness of which is in proportion to the fuel it consumes. The first point is to discover the degree of richness of the natural soil, and then to ascertain the dominant constituent of each plant. Plants are divided into three categories,—*first*, those in which nitrogenous matter is the dominant constituent, such as cereals, hemp, colza, beet-root, and general garden stuff. The *second* group, in which calcic phosphate preponderates, comprises maize, sugarcane, Jerusalem artichokes, turnips, and sorghum. The *third* group includes leguminous plants, such as clover, sainfoin, lucerne, potatoes, and vines, and in these potash is the dominant ingredient.

Now what M. Ville terms "normal manures" contain calcic phosphate, potash, lime, and nitrogenous matter, differing only in the respective proportions of these four substances. By varying therefore, their relative proportion according to the necessities of the particular plants for which they are required, the principle of dominant constituents can be applied to every possible condition which may arise, thereby meeting the requirements and advancing the interests of every description of farming.

It is not necessary to restore to the soil weight for weight, constituent for constituent, all that is taken from it, but the four constituents named above are essential, and must always be added. Analyses of farmyard manure show that it contains the four constituents which it is essential to restore to the soil, but it also contains carbon, hydrogen, and oxygen; also sodiochloride, magnesia, soda, silica, ferric oxide, &c., all of which are abundantly contained in the poorest soils, and which do not therefore increase the value of manure. Farmyard manure therefore owes all its efficacy to the four essential constituents mentioned above. But we have just shown that each of these constituents with regard to the three others fulfils functions that are in turn subordinate or predominant, according to the nature of the plants to be grown; with farmyard manure, however, there is no possible division, its composition cannot be varied. The only alternative, then, is to

use it in conjunction with chemical manures. In practice the quantity of farmyard manure usually applied to an acre of land is, we believe, from 16 to 20 tons, in which quantity the four essential constituents form only about a fortieth of the whole mass. Their proportions are as follow:—

Nitrogen	181lb. per acre
Potash	184 ,,
Phosphoric acid	98 ,,
Lime	352 ,,

To place the land under the proper conditions for high cultivation, the amount of the fertilising substance in the farmyard manure must be at least doubled by means of chemical manures, and in the case of each particular plant it is necessary to concentrate that chemical agent which is especially favourable to its growth. It must also be remembered that one-third of the nitrogen is lost to the soil on account of the decomposition which the manure must first undergo before it can exercise its action. M. Ville strongly advocates the foundation of experimental fields. They are, he affirms, the only reliable method of ascertaining with certainty the composition of the soil with respect to the requirements of agriculture. A piece of land should, if possible, be selected which, in its physical nature and degree of fertility, represents the average quality of the land that is to be cultivated. For a newly-worked farm the field should consist of twenty plots, each containing about four poles, arranged in two parallel rows of ten plots each. The first row should be devoted to the cultivation of wheat, and the second to that of beet-root or potatoes, according to the climate and the wants of the district. The wheat furnishes indications of the richness of the superficial layers of the soil, and the beet-root of the deeper layers. Full instructions are given respecting the manuring of the several plots. M. Ville also gives directions for establishing experimental fields for agricultural colleges, societies, and for elementary schools. For the latter the plots should be about eleven yards square. By carrying out the advocated system of manuring, it will be conclusively established that it is possible to farm without using farmyard manure; that a manure can be, and is composed, which more than takes its place, and that the action of animal manure is intensified by the addition of chemical manure.

M. MONTCLAR'S METHOD OF AGRICULTURE ON STEEP LANDS.

(*Communicated.*)

II.

WHEN opening an estate on the steep lands of the hilly countries of India and Ceylon, the first consideration for men of experience is to select the best forest land.

The selection being made, the operation generally carried out is the *destruction* of the forest trees by felling and burning, and to plant coffee or tea, &c., afterwards. It certainly appears that a soil which has given food to several generations of large forest trees, should be able to feed such shrubs as coffee or tea for a long time.

Unfortunately practically it is not the case; but why not? How is it that after a few years, a virgin soil on steep land which has been planted with coffee, requires to be manured expensively.

Did the forest trees (now cut down and burnt) require any manure? Not only the forest trees did not require manure, but they were producing, by themselves, manure much more than they required, and leaving year after year more or less accumulation of it, which was the *spongious humus* of the forest land, the production of a great many centuries!

It is that *spongious accumulation* which constitutes the richness of the soil of forest land.

It is by that accumulation that the rainfall is retained, and percolates gently through the soil and sub-soil of the forest, and it is *that very percolation* which renovates the "internal moisture" of the soil, and keeps it in a "negative electrical condition"—by which condition only forests propagate themselves for generations so luxuriantly.

But reverse that natural condition (made by a powerful Providence) by artificial means, and within a few years the splendid forest will die out.

For instance, remove entirely the "spongious accumulation" (the humus) of a forest, at once the rainfall will *escape* instead of *percolating* through it as before, when the forest had its "spongious cover and fertilizer." By this want of percolation, the *internal moisture* of the soil is then insufficiently renewed, and become unpleasant and often infectious—internally. Besides, the excrementitious deposits of the roots being thus deprived of sufficient *renovated moisture* (through the soil), transmit to it *some acidity*, by which the soil loses degree by degree its former "negative electrical condition," and turns to the "positive electrical condition" so unfavourable to vegetation.

Therefore if *large* forest trees suffer much, and be brought to the verge of ruin and death by being deprived entirely of their "natural spongious cover and fertilizer," planters working on steep lands will then easily understand how *shrubs* like coffee or tea suffer still more, for many reasons, when they are deprived, "by the washing away of the soil," of their "natural protector and fertilizer"—the humus of the land. It is true, that with the view of preventing "the wash of their land" some planters use *drains*.

Unfortunately these drains, as they are used by planters, do much more harm than good to the plants under cultivation on steep lands. Indeed, the drains as they are used by some, act as artificial channels to carry out of the fields the heavy rain which falls on the land.

Every time that there is a heavy fall of rain on an estate situated on steep land, at once the rain goes to the drains, and hence to the ravines, which discharge themselves into the stream or river below the estate.

When the drains of an estate perform the above work well,—*i.e.*, turn out of the land every heavy rainfall,—the planter considers that his estate is in good condition, as his drains are in perfect order, when on the contrary, acting as they do, they are often the ruin of his undertaking.

Indeed, the true theory of drainage on steep lands is often entirely misunderstood by planters, because the rain-water should drain through the soil first by percolation, and thus only go to the drains by the natural process of filtration.

The rain-water should *never* be allowed *to run off* at once from the surface of the land to the drains, for many reasons of very great importance.

The rainfall on the contrary should be made to percolate (and not to run off at once, and often very rapidly), and then to filter to the drains, naturally in many soils, and artificially in some exceptional cases.

As we have seen above, it is of the highest importance that the rainfall, which is the "natural irrigation" afforded by Nature to steep lands of hilly countries, should not escape rapidly out of the land, but gently, because in its rapid escape more or less of the best arable soil of the land is carried away out of the estate, and the land besides is deprived of renewed moisture through the soil,—a thing of very great importance for the maintenance of the "negative electrical condition of the soil." It is important to consider that the physical circumstances and conditions of the lands of the *low* countries are not similar to those of the *upper* hilly countries. In the low countries, the great question for the agriculturist is to get rid of any excess of "permanent moisture in the soil," because permanent moisture soon engenders infectious acidity in the soil, which converts the condition of the soil from "negative" to "positive."

Hence good drains, as much as possible, are the things which are required in the lands of the low countries, because the retention of moisture generally is not required there, and often it is the excess of moisture which is to be avoided.

On steep lands of the upper countries the retention of the rainfall (which is the natural irrigation afforded to the land) is on the contrary greatly necessary. But that retention has not been understood, and besides has afforded up to this time an enormous difficulty in practice, and hence its escape has been considered as the best means of avoiding difficulties amounting to impossibility on account of expenditure.

Of course, if we have no means to retain the rain which falls on steep lands of the upper countries situated at 2,000 to 5,000 feet elevation above the sea level, then its escape is a forced condition—which is a great pity, because as water does not naturally run up-hill, but on the contrary runs down, how, then, is it possible to get it up again, when it has gone down 2,000 to 5,000 feet below the lands under cultivation.

It is that great problem of "Retention" for the steep lands of the hilly countries, which has been resolved practically and with true economy by M. Montolar for the benefit of planters;—and it is precisely by that great problem of "Retention" that inundation can be avoided in India, that moisture can be secured on the denuded lands, and thus the *reboisement* of these denuded lands secured.

We strongly recommend to the careful attention of the Government of India, the pamphlet of M. Montolar on that subject of great importance—"The famine in India: its causes, remedies, and cure."

Here is the view of a scientist specialist, well-known to the planting community of Ceylon, for his accurate analyses.

"M. Montolar is evidently thoroughly impressed with the good to be derived from breaking up the soil and mixing it well. By this means, in addition to ensuring a better circulation of air, he will accomplish a better distribution of the fertilizing salts in the earth, bringing them nearer the plant rootlets, and so diminishing the struggle for existence on the coffee tree. If M. Montolar succeed in doing this by his system of terracing and forking-in good soil to the roots, without causing more than the present amount of wash on the one hand, or stagnant water on the other, he will have deserved well of the colony.

"His aim, getting as much of the rain as possible to filter through the soil (the true theory of drainage) and as little as possible to run off the surface, is thoroughly scientific. Rain contains appreciable quantities of ammonia and nitric acid, which I suppose are what M. Montolar refers to, by the use of the term 'fluid electric,' the latter of which is certainly produced by electricity. These, though present in exceedingly minute proportions, are known to exert a most important influence on plant life, being the only combinations of nitrogen which plants are known to assimilate.

"The soil attracts and retains for the nourishment of the plant the ammonia in the rain. The nitric acid combines with lime, but is not so completely retained. Hence, as M. Pellet says, nitrate of calcium is a descending salt. The largest proportion of these two forms of nitrogen is always present at the beginning of showers and after dry weather, and of course, when they fall upon an open absorbent soil, are saved from being washed at once into the drains.

"If wash can be prevented by some such system as M. Montolar is devoting himself to, it would enable the planters to get the full benefit of such an excellent manure as superphosphate of lime, containing a large proportion of soluble phosphates. The fact of the coffee tree deriving a large proportion of its nourishment from the upper ten inches of soil would seem to constitute climbing salts, like superphosphate of lime as peculiarly coffee manures. With a freely absorbent soil, the soluble portion would descend at first with the rain, and when fair weather returned, would rise once more to the roots. But even on the present system of cultivation, superphosphate must be considered a most valuable manure, because a large proportion of the soluble phosphate is enabled, by its solubility, to permeate the soil very completely, where it is precipitated again in the insoluble condition, but in a state of minuteness of division, which no mechanical process of grinding or crushing can approach. Its stimulating effect is no objection, as it can be easily diluted with less active substances when found to force the trees too much. Indeed, its stimulating properties can be regulated in the process of manufacture, by adding a larger or smaller quantity of sulphuric acid, and thus converting a larger or smaller proportion of the phosphate into the soluble form. The more economical plan, however, is for the planter to purchase a well-dissolved manure,—*i.e.*, one in which there is the highest percentge of soluble phosphate which he can mix with a certain proportion of bone dust, the latter giving insoluble or slowly soluble phosphates. The chemist cannot state what proportions will be found best in practice. It is this practical knowledge, gained by careful observations, which constitutes the difference between an experienced and an inexperienced planter.

"If M. Montolar had done nothing else, he has, at least, given expression to an idea which has been in many minds, viz., that the specific for leaf disease is smaller estates and higher cultivation,—*i.e.*, the estate must be smaller than the planter may have capital to cultivate highly. It is a startling fact that not only is the total produce of the estate diminishing, but, as I have been informed, the percentage of size No. 1 in the outturn is diminishing also. Exceptional seasons would, no doubt, produce smaller beans, just as the ears of corn are badly filled during a cold summer in England; but when this happens year after year, it certainly points to a diminished amount of available plant food in the soil. This it must be remembered is but imperfectly disclosed by soil analysis, as we cannot imitate the slow solvent process of Nature in the laboratory. Were we to attempt to do so, an analysis would take years instead of days to perform. Let the coffee tree have plenty, but not too much of its appropriate food supplied to it, and let the ground be kept in a good condition of porosity for the infiltration of water and circulation of air, and let the earth about the roots be periodically mixed to ensure a proper distribution of salts. These appear to be the points aimed by M. Montolar, and they are the conditions which every intelligent planter would have endeavoured to attain, if only he could have prevented his labour being spoiled by wash. If M. Montolar accomplishes this physically and financially without producing the opposite evil of standing water, then he will undoubtedly, in his own words, be 'a master of the situation.'"

M. COCHRAN.

Colombo, 14th January 1879.

Let planters work properly their land, so as to avoid the "positive electrical condition," and have it in a "negative electrical condition" by the means explained by Mousr. Montclar, and the Coffee Estates will soon recover from their misfortune.

EDITORIAL NOTES.

We have before us the Annual Report of the Royal Botanic Garden, Calcutta, for the year 1878-79, from which it appears that experiments have been made with a variety of economic plants, in many instances with marked success. The Brazilian Rubber (*Hevea braziliensis*) does not seem to thrive, and this is the less to be regretted, because our own indigenous rubber (*Ficus elastica*) succeeds so well, and is so easily propagated. Neither has ipecacuanha been a success, but the greatest progress has been made in new fodder plant experiments, the *Pithecolobium Saman* having seeded a second time. This admitted of a liberal distribution of seed. During the year 9,595 plants were received in the garden, and 22,771 distributed.

So long as we continue to cultivate the opium plant, there is no reason why we should not get the most we can per acre. It seems, however, that we do not obtain anything like the outturn we ought. We reproduce an interesting article from the *Delhi Gazette* on this subject. It is from the pen of Captain Pogson, who has done so much for Indian agriculture, and we beg to direct the attention of the proper authorities to the sensible remarks contained in the article.

The Madras Government do not seem to have been successful with Bamieh cotton. This is unfortunate, as the Bamieh is a good variety.

Several instructive experiments have been made in Madras with Carolina paddy; it is found not to succeed well, the only reason militating against its success being, that it has a deep tap root, and this cannot find its way through the soil, owing to the very primitive methods of cultivation adopted in India. It would doubtless be a valuable addition to our food crops from this very obstacle which is apparently operating against it, for from its long taproot it will not be so dependent on a water-supply, as is the indigenous surface-feeding variety.

The land under cotton in the Madras Presidency for the three years—1876-77, 1877-78, and 1878-79—has been 1,645,389, 926,115, and 1,165,736 acres respectively, and for the last year the outturn has amounted to 49lb. cleaned cotton per acre. This is very low, when we consider that the American produce is 300lb. per acre, and it does not say much for the future of the cotton industry in India.

We have received an interesting pamphlet entitled "Irrigation and Communal Labour in the Madras Presidency," by Mr. A. T. Arundel, Madras Civil Service. It is an important contribution to the Irrigation question. It appears that the system of village or Communal Labour has fallen very much into disuetude, and the author advocates its resumption for many good reasons which he gives, among which are, that the system is less objectionable to the people than the raising of taxes for the purpose, and that it costs less. The subject is worthy of careful consideration.

The report for the year 1878-79 of the operations of the Model Farm, Nagpore, has reached us, and we notice that much work has been done and the results carefully recorded. In the operations of a Model Farm, one does not always look for absolutely successful results, the very name *experimental* forbids this expectation, and therefore we are not surprised to find the outturn now and again very low; for instance, we are told that the average outturn of tur grain over 21 acres was only 238lb. per acre, while the gross value of the same was Rs. 9. Forty-

one acres were under wheat with an all round outturn of 268lb. grain and 258lb chaff. Total gross value per acre Rs. 13. This is only 4¼ bushels per acre, as against the Indian average of 13 bushels, on the purely experimental portions of the farm; much more satisfactory results were obtained, as for instance 950lb. wheat per acre, equal to 15¼ bushels, this being the result of deep ploughing and manuring. On the whole we do not consider the results as at all satisfactory, and can find nothing in the report which can justify the up-keep of the Model Farm.

WE have been favoured with a copy of the "Prospectus of the Baroda Agricultural Show," to be held on the last three days of this year; and considering that Major Nutt is President of the Committee, and remembering his success at Songad, Kattiawar, in February, we look forward to a good meeting at Baroda. A large sum of money is to be distributed in prizes, which are offered for every conceivable article usually connected with farming operations, from horses and cattle down to fowls and fruits of all sorts; nor are the operations of farming neglected, as we observe prizes are offered for the best implements and for the best results in ploughing.

THE rats have again begun to breed in the Dharwar district, and threaten to overrun the country once more. Government has not, however, relaxed the war that has been waged against these pests, and we must hope that future operations will be as successful as those of the past. Nearly eleven million rats have already been accounted for in the Bombay Presidency. Crops in the Southern Mahratta country are looking very well, but more rain is now required in the Eastern districts. The really trying time, however, when the dry east winds begin, has not yet set in. In Khandeish and towards Cawnpore the gingelly seed crop has been considerably damaged by heavy rains.

THE special organs of the tea trade concur in taking a sanguine view of the position of the tea market, which is said to show signs of a speedy general advance of prices, the movement being traceable to a strong export demand for common tea. Importers have also changed their tactics and helped to strengthen values. The latest advices from China indicate that supplies of Northern teas will prove short of last season, a stoppage of arrivals from the districts having been caused by the dissatisfaction of native dealers with the prices lately obtained. A large quantity of common loaf is also being taken off the China market for overland transit to Russia. Another authority considers the prices may advance if, as is estimated, the supply from China should prove to be from 20,000,000lb. to 30,000,000lb. below that of last year, but adds that an improvement in the rates obtainable on this side would induce an immediate increase of shipments from China, and that meanwhile large stocks, which will have to be sold at no distant date, are held by importers.

THE possibility of a resumption by India of the export of wheat on a scale similar to what we witnessed three years ago, is being discussed by those interested in the trade in England. The position of this commodity and the prospects of the market are soon explained. The consumption of wheat and flour in the United Kingdom is supposed to be about 450,000 quarters weekly, or at the rate of 23,500,000 quarters a year. It is believed that not one-half of this was contributed by home growth, which was far below an average, and England actually imported last year twelve million quarters of wheat and nearly three millions more in the shape of flour. In fact, the deliveries from the farmers during the season were reckoned at only some ten millions quarters. But this year the crops are incomparably worse, and the most sanguine do not look for a yield of wheat more than two-thirds of that of 1878, say, eight millions quarters at the outside. Thus 16,000,000 quarters of foreign wheat are wanted to meet that deficiency alone. But in addition all other cereals are short, and the potato crop is threatened with utter ruin. Now, hitherto the United States have been the main source of supply, but no more than 900,000 quarters a month is being imported thence, and after America there is only Russia and the remote East to look to. But much of the Russian supply is needed for France and the Mediterranean, for Italy also has short harvests, and what Australia, Chili, and such remote sources can send is but trifling. At present low prices. For India, therefore, there is a chance, and the idea is that when wheat has risen four or five shillings a quarter, Indian produce will be shipped. No doubt the same rise in price would also bring more from America, but it is thought the demand from all Europe will be active enough to take the surplus of the States and India too.

WE note that the total area of land under tea cultivation in the Rajshahye and Cooch Behar division during 1878 was 34,356 acres, showing an increase of 221 acres over the previous year, and the quantity of tea manufactured was about 7,535,980lb., or 2,200,000lb. in excess of the outturn of 1877. At the end of the year under report, 29 gardens had been opened in Julpigoree and 144 in Darjeeling. The Government Cinchona plantations, which cover more than 2,000 acres, yielded 250,000lb of bark during the year, and a profit of about half a lakh was obtained on the operations of the season. Of the outturn of febrifuge manufactured from the bark, 5,500lb. were supplied to Government medical depôts in the three presidencies, and the rest was sold to the public. Gunny bags are manufactured in most districts of the division. During the year the mills of the Serajgunge Jute Company turned out 110,000 maunds of gunny, or 20,000 maunds more than in the previous year. The bags are sold for the country trade and for exportation to Egypt and Australia. In Julpigoree and Darjeeling two Nepaulese worked some copper and iron mines with moderate success.

ALTHOUGH prospects of good crops being reaped in Western India during the ensuing season are at present favourable, we regret to learn that there are some portions of the Poona and Sholapore collectorates where the ryots are again threatened with a plague of insects. In some parts of the Presidency also the cultivators, from long successive failures, appear to have lost heart, and do not care to sow their lands at all. Especially is this the case in those districts where forest denudation has been too long permitted, and where the hills are now left barren and bare, and incapable of performing their proper function of storing the water brought by the annual monsoon. In such districts the heavy rains run off as soon as they fall, and in a few days the country is left as dry and as arid as if there had been no moisture at all. "The general public has little idea," says the *Bombay Gazette*, "of the extent to which forest denudation has been carried on during recent years, for in many places there are whole ranges of hills upon which hardly a blade of grass finds subsistance that only a score of years ago were covered with vegetation and valuable woods." It is satisfactory to learn that under a recent order it has been decided that all hill and mountain lands of the Presidency, the occupancy of which has been relinquished, shall at once be thrown into forests, and that hereafter such lands shall not be given to cultivation. As to hill lands that are occupied, Government has wisely ordered that they should be purchased whenever practicable.

SOME farmers, whose land is exposed to sweeping winds, have tried the sowing of one bushel of oats with their winter grain as a protection to that against the excessive cold and exposure. The oats grow up much more rapidly than the wheat, and help to shade and protect it. When killing frosts occur, the oats perish, but in falling, still cover the wheat with their mantle of straw, and the protection remains through the winter, sheltering the wheat-roots. The little that is drawn from the soil by the oats is returned to it by their decay, and the benefit to the wheat is apparent when growth begins in the spring.—*Agriculturist.*

COLONEL OLCOTT announces that he has received a letter from the Hon'ble Edward Atkinson, an eminent American political economist, which contains the important news that a simple method of converting cotton seed into a nutritive article of food has been discovered. Mr. Atkinson says:—"If you can obtain light naptha, or gasoline, in India, you may do good to the poor classes by leaching the kernel of cotton-seed with it. It removes all the oil, which can then be separated from the naptha in a very pure state; next, dry off the kernel with hot steam, and you have a sweet and a very nutritious food. I suppose they have hulling-machines in India. The hulls make good paper. I expect to see our crop of cotton-seed worth half as much as the crop of cotton." Colonel Olcott has written for further particulars as to the process and machinery required.

COMMUNICATED AND SELECTED.

CAROLINA PADDY.

IN their proceedings recorded with G. O. Revenue Department, dated 12th April 1878, No. 587, the Board expressed an opinion that it was not advisable for Government to take expensive steps to force the cultivation of Carolina rice, but that it might be continued at the farm, and cultivators supplied with seed when a desire was expressed to obtain it, on payment.

The Government decided that no further steps other than those indicated by the Board would be taken for the present, but desired fuller report on the point by Mr. Robertson and Collectors interested.

Reports were accordingly called for from the Collectors of Chingleput, Nellore, North Arcot, Bellary, Tanjore, Coimbatore, Malabar, and from the Superintendent of Government Farms. These have now been received and will be submitted for the information of Government.

It will be seen that most Collectors are of opinion that no further experiments are called for, but Mr. Whiteside is anxious to go on with them, as his previous experience was very satisfactory, and Mr. Ross, the Head Assistant of Bellary, also expresses a desire to personally conduct an experiment.

Illustrating his suggestion by a reference to casuarina topes in the neighbourhood of Madras, Mr. Price remarks that in his opinion the only way to forward such schemes is for Government, or some enterprising European, to grow what it is desired to introduce beside the crops of the natives, and to let them see what the advantages of the products really are, and still further, that it brings in better products than what they themselves raise.

In the present state of demonstration of the advantages of Carolina paddy the Board doubt whether the enterprising European will be forthcoming, but they fully concur with Mr. Price in considering that it is the only form in which any further experiments should be prosecuted. Tolerably extensive cultivation of the crop in one locality under carefully selected superintendence will lead to much better results in the long run, than widespread experiments under the supervision of the District Officers who may happen to be at hand.

They may also remark that the reports now received indicate that as yet nothing whatever has been attained in the way of inducing the ryots to adopt the cultivation of Carolina paddy, and that the demand for seed on payment will be absolutely *nil*.

They are further of opinion that Carolina paddy having a deep taproot is not suited to ordinary paddy lands and will flourish only in a deep and light sandy soil without a substratum of clay—well drained soil in which it will not be subject to be water-logged.—*Madras Athenæum.*

NATIVE AGRICULTURE IN JAFFNA.

(Jaffna Morning Star.)

THOSE who have seen how agriculture is carried on in Europe or America have, we know, often denounced the very primitive ways of this art as practised in Jaffna. It is strange indeed to see that the Jaffanese—who have in their course of civilisation so much adopted the ways and means of the countries of the West—take no pains to improve their mode of agriculture, the great object of which is to raise on any given space the greatest quantity of vegetation, consistently with a due regard to the quality of the produce. In this as in many other affairs of life we think the nature of all Eastern nations is such that they require somebody to lead them and put them to work out the improvements. We are glad to know that one or two Jaffna young men have been fortunate enough to be admitted into the Madras Agricultural College.

In order that agriculture or tillage be successful, aside from the natural or artificial conveniences of irrigation, soil, and climate, it is generally admitted that three things should be done to the land. They are, *ploughing*, *manuring*, and *weeding* in their widest senses. Native ploughing more than anything else seems to be the thing complained of by those foreign friends who know, if they know at all, about agriculture. It is deep ploughing, as deep as the surface soil may safely admit of, if not a little of subsoil ploughing here and there, that is required in Jaffna we believe. Our ploughs simply scratch the surface of the ground and do nothing to retain moisture is what we have been repeatedly told of. We are glad to extract here from the *True News*, a piece relating to the first turning of the sod in a village in Madura with a foreign plough.

Some months ago the Superintendent of the Experimental Farm at Sydapet sent the Rev. W. S. Howland one of their ploughs modelled to meet the practical wants of Indian farmers in point of cheapness, lightness, and ease of draft. The results of his experiment with it at Mandapasalai, Mr. Howland narrates in a note this morning :—" The first time I tried it, the ground proved too dry. The next time I had 40 spectators and plenty of criticism, and the oxen frightened as well as the workmen. The onlookers knew it would never work ; one man would be needed to pull the oxen by the nose, a boy to punch behind, and a man to attend the plough. At the next experiment the oxen became the quieter and walked in the furrow and actually made some attempts to turn around at the end, and we dismissed the boy to punch. By this time the farmers began to look at the work done as well as us, and were all admiration at the depth and breadth of the furrows and the way the plough covered up the weeds, and wished to take hold of the plough handles. At the last trial this morning, the driver was dispensed with, the oxen's nose ropes lengthened and tied to the plough handle, and the oxen came around at the end of the furrow in defiance of all the ancestry of Hindu plowmen and oxen. My bandy man then continued the ploughing alone till he had finished the plot marked out, a full half acre. The work is not very hard for good oxen ; and moreover they have gone contrary to tradition. It is a pleasure to see land so neatly and evenly turned. I am having an A harrow made, which I hope to try upon the same ground."

In this connection we are glad to know that a foreign plough (we do not know whether it is an English, American, or a Swiss one) has been received this month in Jaffna by a gentleman, who has the object, we think, of influencing natives to a better way of *moving* the earth. English ploughs have been for sometime past in use in the cocoanut estates of Pachilapallai, but with what results we do not know. But we are sure that no native has ever in Jaffna troubled himself with a foreign plough, as a matter of experiment at least in his fields. The prices of foreign ploughs that may be made useful in Jaffna are not very high, we think, so as to hinder a Jaffnaman possessing a moderate farm of a 100 or 200 lachams of paddy or varego culture from buying it. If we remember aright the prices of the Swiss ploughs kept for sale at the Saidapet Farm of the Madras Government range between Rs. 15 and Rs. 30.

OPIUM.

CERTAIN members of Parliament, who take an interest in Indian affairs, have annually something to say on the subject of the precarious natur of the Opium Revenue, which it is feared would vanish altogether if the Chinese took it into their heads to perfrom what may fairly be called two impossibilities. The first being the cultivation of the poppy and the manufacture of opium on so large a scale as to render the opium of India unsaleable. The second is the absolute abandonment of the use and abuse of opium by the entire Chinese nation. Now if this was all we in India had to apprehend, it might safely be predicted that our Opium Revenue was safe for centuries to come. But unfortunately the real and great danger lies, and has lain for years, at our very threshold. I allude to the silent and gradual exhaustion of the soil of the poppy districts from constant cultivation of the poppy plant.

The surrender of £200,000 of the cotton duties has convulsed Calcutta, Madras, and Bombay, and enabled numerous members of Parliament to say very bitter things about India and its finances. But not a word has been said either in England or India, about the very heavy and serious losses already sustained by the failure and deterioration of the poppy crop. If the information to hand is to be relied upon, then it must be admitted that during the year 1877-78, the poppy crop of the district of Sarun was affected by poppy blight, and brought about a loss of twenty-seven lakhs and fifty-two thousand rupees, and as the loss during 1878-79 in the same district amounts to fifteen lakhs and seventy-five thousand rupees, we are forced to arrive at the conclusion that forty-three lakhs and twenty-seven thousand rupees (at par £432,700) have been lost to the State through bad husbandry.

The question naturally arises,—What is to become of the Opium Revenue if these losses (more or less) are repeated annually in the six great opium districts north of the Ganges,—namely Sarun, Chupra, Bettiah, Motihari, Tirhoot, and Hajipur.

The head of the Opium Department, and the numerous active, intelligent, and zealous officers under his orders, cannot be blamed for the present state of affairs. The Agricultural Department being defunct, is relieved from any responsibility, real or imaginary ; and it is of no use crying over spilt milk, the ryot and zemindar must be taken in hand, and all future poppy cultivation be carried on in a proper and scientific manner.

The system of culture which in thirty-seven years has produced the results under review, is thus set forth by Mr. W. B. Johnson of Patna, and appears in detail in O'Shaughnessy's Bengal Dispensatory, pp. 748, 749.

" A beegah of good land requires about three seers of seed, if not required " to be resown, and yields to the ryot fifteen seers of opium. At the " present price paid for it by the H C., Co.'s Rs. 3-10. this gives Co.'s Rs 54-6. " Five maunds of seed at the average bazaar rate of 25 seers per rupee " bring eight rupees. The leaves are also bought for filling up the chests " in packing, at four annas per maund. The petals are formed into masses " and paid for at first quality Rs. 10 per maund, second quality at Rs. 7 ; " third quality at Rs. 5, produce say Rs. 15, so that the total value of " a good beegah of opium land is Co.'s Rs. 80, with the stalks for firewood, " exclusive of other crops in the year.

" The quantity of opium paid for in Sarun in 1840 was 8,507 maunds 13 " seers 15¾ chittacks."

As regards culture, Mr. Johnson states :—" The poppy requires a good, " rich, dark soil, well prepared with manure. The sowings commence " early in November. The day the seed is sown the land is well watered. " The plant soon shoots up, and when about six inches high, it is thinned

"and weeded; it is kept well watered, until the capsules are nearly ripe "and the petal falling off; it then depends on the state of the weather; if "mild, the irrigation is continued; if strong winds, it is discontinued for "fear of being blown down."

The water used or irrigation was drawn from wells, and the manure wa supplied by the ryots' cattle.

The reader, if acquainted with even the rudiments of scientific agriculture, will not fail to observe that whilst an unknown quantity of cowdung manure was put into the poppy fields of plots, every particle of produce was carefully removed. From 1869-70 to 1876-77, the actual quantity of opiums produced in Sarun on the average per beegah was seers 4½ and 14 chittacks, or sixteenths of a seer, and this quantity divided by eight (the number of years) given as quotient, five seers three chittacks and three-quarter tolas; and if this quantity be deducted from fifteen seers, the rate of production of opium per beegah in 1840, the difference, nine seers twelve chittacks and one-and-a-quarter tolas (grains 225) represents the average annual loss sustained by bad husbandry, by which expression is meant, assiduously exhausting the soil, first by growing the same crop (poppy) annually on the same plots of manured land, and not returning even a leaf, flower, petal, or stalk of the plant raised to the ground: and second, by sowing as soon as the rains commence, grain crops and anything else, on the land *just sufficiently manured* to produce a crop of poppy, and so removing therefrom a further and larger supply of mineral matters, not an ounce of which is likely to be restored to the soil. Mr. Johnson has told us that this system was carried on in his time (1840); and Mr. Tytler, the Sub-Deputy Opium Agent in charge of the Sarun Opium district, supplies information which gives us the practical results of poppy cultivation on this plan.

"In 1877-78 the Sarun poppy crop was suddenly destroyed by blight of the most virulent type. A first class crop was on the ground, but without warning in ten days it was entirely destroyed by the devastating action of the poppy mould. About the beginning of February 1878, the cultivators expected a full crop, and Mr. Tytler himself estimated the promised outturn at not less than seven thousand maunds, or about six seers and four chittacks per beegah." The reader will realise the intensity of the disaster when it is known that only 1,495 maunds remained." In the present year (1879), Mr. Tytler has obtained about 3,150 maunds, or almost exactly *one-half* of the total outturn of his sub-division in a prosperous year.

The long-continued drought destroyed one portion of the poppy crop, and but for Mr. Tytler's system of well-irrigation it would have been almost impossible to hope for any kind of poppy crop.

The extent to which bad husbandry was carried by the poppy cultivator, is proved by the statement published in the *Englishman*, by its correspondent C. J. W. D., that:—" A considerable part of this year's crop failed because it was grown from the blighted seed of 1877-78."

In 1876-77 we are told 45,671 beegahs of land were under poppy cultivation in Sarun, and produced maunds 7,202 of opium. The average yield per beegah being six and a quarter seers. In 1871-72 the land under poppy measured 48,058 beeghas, the yield of opium was maunds 4,429, and the average yield per beegah was three seers and eleven chittacks. Compare this with the yield in 1840, of fifteen seers, and we have a loss sufficiently startling to demand attention.

In 1877-78 the expenditure under the head of opium is put down in the Budget accounts at £2,661,260, and the income or revenue at £9,182,722; and, as fully two hundred and forty lakhs of rupees must have been laid out in opium advances to cultivators, the income should have been very much greater. The fact of its not being so, proves conclusively that the system of poppy cultivation hitherto pursued must be abandoned if the Opium Revenue is considered of sufficient importance to be properly supervised and permanently maintained.

In 1869-70 I foresaw the necessity of placing a cheap and efficient manure for the poppy plant at the disposal of those concerned, but with the exception of a European gentleman who held some land in Oudh, no other person wasted a thought on "poppy manure," and how to make it for general use. This gentleman cultivated the poppy, manured the land as directed, and obtained therefrom exactly double the quantity of very superior first class opium that he would have done under the old and time-honored system. The comparative experiments, very carefully conduct by him, demonstrated that one beegah of land, manured according to my plan, gave twice the quantity of opium than that obtained from the same extent of land not so manured. The details and results of all the experiments were printed in a pamphlet, and copies were sent to the authorities. Mr.—— was very shortly after placed in charge of a Government model farm, where poppy was not grown, and his valuable personal knowledge and experience was got rid of. I received a copy of the pamphlet and sent it as a present to the Library of the Agri-Horti cultural Society.

The opium produced by me at Simla, and sent to the Agri-Horticultural society, was analysed by order, by Doctor Mactier, and was found to contain seven per cent. of *morphia*, whilst the best Government opium contained only three and-a-half; and there the matter ended.

I could easily submit an inexpensive and efficient plan of operations to prevent further derangement of the Opium Revenue. But courtesy demands that the officers of the Opium Department should have the opportunity afforded them of placing poppy culture on a satisfactory footing.

J. [illegible]ED. FOGSON.

Delhi Gazette, August 22, 1879.

A FEW ADVANTAGES OF THE USE OF LIME.

THE advantages of the use of lime are so many and so great, that it is almost impossible to enumerate the whole of them. Their effects may be described as being both chemical and mechanical, and as being exercised both on the organic and inorganic constituents of the soil. The following may be taken as a summary of the principal benefits:—

"1. A large produce of cereal crops of superior quality. This is especially the case with wheat, which becomes thinner skinned and yields more flour. The peas grown upon limed lands are better boilers.

"2. Upon deep alluvial and clay soils it increases the crop of potatoes and renders them less waxy. Sprinkled over potatoes in the store heap it preserves them, and when riddled over the cut sets, it wonderfully increases their fertility.

"3. Lime eradicates the finger and toe disease in turnips, and gives great soundness and more nutritive qualities to the bulbs.

"4. It gives, when applied to meadow lands, a larger produce of nutritious grasses, and checks foot-rot in sheep depastured upon them. It also exterminates bent, as well as coarse and sour grasses, destroys couch grass, and acts powerfully upon the rye grasses.

"5. Upon arable land it destroys the corn-marigold and weeds of various kinds.

"6. It rapidly decomposes vegetable matter, producing a large amount of food for plants in the form of carbonic acid gas.

"7. It destroys or neutralises the acids in the soils, hence its adaptability to our soils.

"8. It acts powerfully upon some of the inorganic parts of soils, especially on the sulphate of iron found in peaty soils, and sulphates of magnesia and alumina.

"9. It proves fatal to worms and slugs, and the larvæ of injurious insects, though favourable to the growth of shell bearers.

TROPICAL CULTURES.

FROM the last official report of Mr. W. Prudie, the Government Botanist of Trinidad, we extract the following interesting notes on the culture of various tropical economic plants and trees:—

Sugarcanes.—To the collection of these formed in 1875, three other remarkable varieties have been added, and are now in sufficient quantity to be offered for distribution. They are named provisionally "Caledonia, Queen," "Green Salangore," and "Violet Salangore."

No. 1, *Caledonian Queen Cane*, is a pale or greenish purple cane, close jointed and extremely vigorous. The leaves are remarkably broad, and their bases are nearly destitute of the setæ or "cowitch" common to most canes. This cane is said to attain enormous dimensions in the East, and to be one of the most sacchariferous. The short joint is a feature which is generally considered objectionable—accompanied as it usually is by great hardness of cane tissue. In this respect, however, the Caledonian Queen Cane is an exception, and the ready way in which both length of joint and diameter of cane is affected by manure—the natural soil at St. Ann's being of the poorest—indicates great variability of habit, and suggests gigantic growth under the influence of rich alluvial.

No. 2, the *Green Salangore*, is so named from its retaining a green colour on the cane much longer than usual, although when fully ripe the colour of the cane is yellow, but not so bright a yellow as that of a well ripened Otaheite. This variety is the freest growing of all the varieties in the gardens, except the giant Claret Cane, and its *erect* habit is even more striking than in that variety. Both in respect of length of joint and diameter of cane it is equal to it—thus being the largest yellow cane grown here. The foliage is large and heavy as in Nos. 1 and 2 and 6 of the former series, but completely deciduous, so that the operation of "trashing" is with it reduced to a minimum. The most striking feature in this cane, besides the size, is the broad white rim just below each joint.

No. 3, the *Violet Salangore*, has the habit of erect growth more strongly developed than is seen in any other of the canes enumerated, as it is distinctly the longest jointed and tallest, with a full average diameter of cane. The leaves are long and narrow as compared with the well-known Otaheite.

The remarkably erect habit of growth in these two Salangores is a character which, considering the influences most conducive to a highly saccharine juice and large yield of sugar per acre, is of importance, and on this account it is deemed desirable that they should be brought into notice if only for experiment.

It is generally admitted that the successful sugar cultivation of the future will mainly depend on an increased yield of sugar on weight of cane, just as the beet-root cultivation has become an established industry of immense importance mainly by an increased yield of sugar per ton weight of root—brought about, not only by improved tillage and manufacture, but by the propagation of roots (in this case by seed), which were found to contain most saccharine juice—the most valuable roots being, as with all the

varieties of beet, those which raised themselves furthest *out of the ground*, as circumstance not a little tending to reduce the cost of gathering in.

One of the most commonly observed facts on a sugar estate is that canes grown erect, and therefore enjoying full sunlight and air, are yellow and "full of sugar," whereas canes lying on or near the ground, and thus deprived of light and air by their erect companions, are green and deficient in sugar. The erect or decumbent postures of the cane are in a measure dependent on soil and the kind of culture they are treated to, especially when young, but under any circumstances a marked disposition to maintain an erect habit of growth is an obvious advantage in respect of the sugar yield.

It is generally admitted that a yield of three hogsheads per acre is a maximum yield—and of rare attainment; a larger yield is scarcely thought of—even as a possibility, yet it is a fact that a yield of 2½ or 3 hogsheads is attained from fields in which a very large portion of the canes are trailing, that is to say, green and deficient in sugar. The question naturally arises as to what the yield would be if *all* such canes (being erect, and therefore rich in sugar) were up to a high level yield. In this view it is not difficult to imagine a yield of 4½ or 5 hogsheads per acre.

It would be highly instructive and doubtless encouraging—in the face of beet-root success—if every planter, judging himself to have a piece capable of yielding 2½ or 3 hogsheads per acre, were to test the saccharine contents of one of his best (most erect and yellow) canes, and that of one of his worst (most decumbent and green) canes of such field, then estimate the yield per acre by this best and this worst respectively, from the calculated weight of cane on the ground. Such a test seems to be one of the first steps towards increasing the percentage of sugar to weight of cane, and of course the yield per acre, in the manner that has been accomplished in such remarkable degree with the beet-root, and like which there is no reason why sugarcane yield should not be doubled in a few years.

With regard to the several varieties of sugarcane already introduced from the East, as well as the three varieties now newly brought into notice, there has not been so far any opportunity or proper means for testing their specific and individual characteristics in respect of their habit of growth and sugar yield under extended cultivation. It is most desirable that all the more promising kinds should be fairly tested, and their individual and distinctive features determined. To do this it is indispensable that each variety be kept and treated separately, and experience has shown that it is a mistake for one person to deal with more than one variety when experiment is determined on. However intelligent and energetic the superintendence, it is next to impossible, with the assistance usually available, to maintain, or even to plant a collection of sugarcanes of several varieties without getting them mixed. Besides, ten or twelve stools grown under *fair average conditions* of the estate, are all that is required to accomplish a full and satisfactory experiment. Such stools placed not less than eight feet apart in a single row and kept free *of any other plants*, will furnish reliable material for any years and data for estimating yield per acre.

Coffee.—An extended nursery cultivation of coffee in the Botanic Gardens includes the varieties Liberian, Menuda, Hybrid Moka, Moka, and Arabica (Creole) in large quantities; and varieties Narrow-leaf, Eden, Moka Retziel, and Bengal in smaller quantities.

The varieties mentioned have already been described, but it is desirable to mention that in respect of the Hybrid Moka and the two leading Java varieties, Menuda and Narrow-leaf, their character of remarkable vigour and fruitfulness has received further confirmation in the progress they have made during the past year. The progress of the Liberian coffee and its signs of fruitfulness are equally satisfactory. The state of the larger plants indicates that shade will be scarcely, if at all, necessary for them in ordinary good soil in watered valleys and moist or swampy land.

It should be distinctly understood, however, that Liberian coffee is no to be looked upon as a complete *substitute* for Arabica, Moka, or other varieties of coffee, as imagined by some, except, that is to say, in low, swampy, or what is known as "heavy bottom" land, or very rich soil, in which ordinary coffee, if grown, would not be fruitful, but where the Liberian coffee would be at home.

Liberian coffee is thus specially valuable as an adjunct for either swampy land or poor moist valley or plain land. It is more particularly valuable for planting about cacao estates, where the land being moist enough and the aspect suitable for cacao the land is stiff or poor. It is also obviously well adapted for growing amongst cacao trees where they have become worn out and irregular.

As an indication of the value of Liberian coffee under cultivation, it is deemed desirable to mention some of the computed results of the prospective operations in Liberia of the "Liberian Company" lately registered in London. The price lately realised there for the usual roughly prepared samples is stated to be 105s. 6d. per cwt. The trees are estimated to stand 400 to the acre, *i.e.*, about 12ft. apart; and these trees are calculated to yield as a minimum (at five or six years old) 800lb. coffee per acre. The trees are stated to grow 20ft. to 30ft. high when not pruned.

Oranges and Limes.—In view of the fruit trade that is certain to develop as soon as direct cargo steamers run regularly between this island and Europe and America, the cultivation of oranges and limes on small properties, or as auxiliary crops on large ones, should be regarded as deserving the best attention of those who, desiring a stable prosperity for the island, rightly divine it to be secured by an agricultural produce as varied as possible.

A large supply of plants has been obtained of the true Portugal (not Mandarin) or silver orange, St. Michaels, and the best selected native oranges. Sample boxes of these latter oranges sent to London in 1877 were pronounced superior to any met with in the English market for juiciness and fulness of flavour, excepting some sent at the same time from Brazil, and which were taken to be of the same variety.

It would appear that the average quantity of oranges ordinarily given by full or nearly full-grown trees is not generally known. It is therefore deemed desirable to give the results of observations made on four orange trees in the Botanic Garden during the last six years. These give a lowest average of 500 oranges each tree as the annual crop. This result has this year had confirmation in the fact that trees of average size in the Belmont quarter have yielded over 1,000 oranges each. Such trees in cultivation would stand 25ft. apart, and thus 65 to 70 trees per acre. These would give a crop of 32,500 oranges, which at 5s. per box (100), would realise £81-5 per acre.

The samples sent to London in 1877 were valued at 8s. per box; those from Brazil sold at 11s. per box. Further, it was advised that with proper and systematic packing the value would be considerably increased.

A most important and encouraging feature in the Trinidad (and Brazilian) orange crop is that as a rule it comes in fully eight weeks before the Mediterranean crop, *i.e.*, August, and therefore for that time would supply the London market when barest. There are seasons, however, such as that of 1869 and last year (1878), when the oranges ripen late, *i.e.* in October, and are therefore not available for despatch to the London market till it is also being supplied from the Mediterranean. The character of the fruit too, as a late crop, is watery and deficient in flavour until, as it were, the fruit is over ripe for exportation. The reason for this is, however, easy to explain and easy to understand; and happily the occurrence of a "late" crop can be prevented, so that by orange cultivation in Trinidad the English market could always be supplied from August to October.

The nature and disposition of the orange tree [in this island] is to make its grand annual flowering in February or March (it does flower wholly or in part then, howsoever dry the weather may be), and if the weather be showery and thus favourable for the growth of the young fruit which follows the flowers, these develop rapidly and give the early—August and September—crop. If however the weather in March and April be severely and continuously dry, the young fruits following the February or March flowering fail and drop off, thus arresting the expanding energy of the tree, until the recurrence of rain in May or even June, when a second crop of flowers is produced, and is followed by the fruit, which develops into a late—October and November—crop. This happened last year. The remedy to this late crop is irrigation at the time of, or soon after, the first flowering in February or March. It will not be absolutely necessary to irrigate every year, but having the means, a heavy early crop could always be secured.

An objection to orange and lime cultivation is commonly raised to the effect that the trees get blighted, or die out suddenly in a manner that never happened "formerly;" and in 1869 it was generally remarked that oranges and limes were "killed out." All these statements are based on facts, but the cause and effect are not understood in respect of them.

During a run of six or eight favourable years, oranges and limes spring up in all directions, and according to the custom of the country are left to grow, some in bad soil—often mere gravel or sand—some in low moist places, others in raised and dry. The great majority thrive till the occurrence of an extra severe dry season, when those happening to be in the poor or "high and dry" land die suddenly. Meanwhile, others more or less favoured are proportionately injured, and at length some fall victims to blight always in attendance on trees of failing health—whether from drought or any other cause.

The great instance of the destructiveness of the blight commonly cited is the disappearance along the grand Eastern and the Santa Cruz roads of the limes which, formerly planted as hedge plants, lined these roads almost continuously. It will be remembered, however, that years ago these limes were planted in almost new soil, that ever since the roadside canals have been gradually deepening and widening, and the banks in which the limes at first grew so well have long ago been scraped and drained into dry and barren gravel heaps. No wonder that the lime trees, first becoming sickly and blighted, suddenly disappeared on the occurrence of a season such as that of 1869.

That this view is correct, and that there is no evidence in this occasional disappearance of the trees by drought or blight, that the climate and general conditions of the country are not highly favourable for the cultivation of the orange family on a large scale, is sufficiently proved by the numerous instances of wonderful vigour and fruitfulness in trees over 50 years old in the very same districts in which lime trees are said—and truly—to have died out.

Lime and orange trees are certainly amongst the fruit trees to which the conditions of climate and soil of this island are ordinarily most favourable. The perfection of conditions favourable to the cultivation of the orange family on an extended scale is found, however, in the Montserrat quarter.

Limes are at present to be most profitably utilised in the manufacture of lime-juice; but their great and well-known superiority over any other variety of lime or lemon would render them a speciality in the English market, as they are already in the American—once arrangements were made for their transmission by steamers.

CHICORY.

According to the annual report of the Inland Revenue Commissioners, the cultivation of chicory in the United Kingdom makes no progress, the quantity produced in this country bearing but a small proportion to that imported from abroad, on account of the cheaper rate at which the root can be cultivated in some foreign countries and the channel islands. With reference to coffee and chicory, the Principal of the Laboratory further writes.—"Owing to the ease with which roasted vegetable matter can be prepared so as to resemble coffee in appearance, substitutes for, or adulterations of, it are of somewhat frequent occurrence. The substance most recently detected as an adulterant is date-stones, which, after being roasted and ground, form such an imitation of coffee as would, when mixed therewith, readily deceive the general public. The very worthlessness of this substance is a reason why it would not be likely to be detected by the consumer when mixed with coffee, for, having no decided character of its own, it acts simply as a diluent of the coffee. With hot water it yields an extract of very low specific gravity, and containing only a small quantity of colouring matter and sugar. The early detection and suppression of this mode of adulterating coffee were effected in consequence of information sent by a supervisor at Liverpool, that many tons of date-stones, a refuse from a manufacture of spirits at one of the distilleries there, and which had up to that time been considered useless, were being bought by foreign gentleman to be sent to Manchester, and believed to be intended as an adulterant of coffee. The inquiry made led to the discovery that a manufactory had been started in Manchester for the preparation of 'Mellilotine coffee,' a compound in about equal proportions of coffee, chichory, and date-stones. Since the close of the financial year a seizure has been there made of about seven tons of the 'Mellilotine coffee,' and of the prepared date-stones. The manufactory had barely got into working order, and very little of the 'Mellilotine coffee' had been sent into consumption. Of nine samples examined under this head during the year, two have consisted of 'Chicorene' a compound of chicory, cocoa, and orange-berries; one of 'Coffeetina,' a mixture of coffee, chicory, and roasted figs; one of 'Mochara coffee' (roasted figs); two of date-stones; and three of genuine coffee and chicory."—*Ceylon Observer*.

FARINA.

Wheat is the prince of grains. It contains not only starch and other constituents common to all grains, but a large per cent. of gluten—the plastic principle of grain. So it yields a larger amount of nourishment than any other of the cereals. Animals who live on grain composed largely of starch are not well nourished, do not thrive well and long on starch alone, but live and flourish when gluten is contained in considerable quantity. They do better still when they can get for food a mixture of all the constituents of the grains. These constituents exist in all, but not in the same proportions. Maize contains more oil, wheat more gluten. Some grains contain comparatively little oil or gluten. Oatmeal is obtained by kiln-drying the oats and removing the outer skin. Its flour is coarser than wheat flour. Its taste is peculiar, and not always liked. The Scotch oatmeal is coarser than the English, and is more highly valued. Barley is very little used in making bread. Pearl barley is the grain deprived of its husk, rounded and polished by attrition. Patent barley is pearl barley ground to the state of flour. Barley contains but very little gluten in a free state. Its plastic matter is albumen and casein. It cannot be made into vesiculated bread, but a bread is formed of it by mixing wheat flour with barley meal. It is less digestible, less palatable, and less nutritious than wheaten bread. Barley water, so useful as a nutritive and demulcent drink in sickness, is prepared from pearl barley. Barley under the influence of warmth and moisture, germinates, and the growth of the sprouts being checked by exposing the grain to heat in a kiln, is called malt. It contains diastase, that converts the starch into dextrine and sugar. The malt, infused in hot water, yields sweet wort, rich in sugar, and used for making beer. Rye in form somewhat resembles wheat. The centre is starchy, and the grain contains some gluten, and so may be made into vesiculated bread. It is the staple food of some sections of the earth, in which wheat will not grow. It has nearly the nutritious value of wheat. Its brown colour and acid taste, render it of much less value. Its relaxing effect upon the food canal renders it useful in constipation. Maize exists in many varieties. Pop-corn has the peculiar quality, on exposure to strong heat, of turning inside-out. All the varieties, deprived of its hull and broken, or coarsely ground, are known as hominy-samp, or grits, which is boiled and eaten like rice. It contains but little gluten and so is not fitted for bread, unless with wheat or rye. The brown bread of the Eastern States is a mixture of wheat, maize, and rye meal. Maize meal is made into a porridge or mush. Maize has a peculiar flavour, much disliked by children. It contains a large amount of fat-forming matter, so that on keeping for some time and exposed to the warm air, it acquires a rancid taste. It contains a large percentage of starch, and a small one of plastic, fatty, and mineral matter, and so is not a nutritious article of diet. To obtain a sufficient amount of nutriment a very large quantity must be eaten. Starch, eaten with plastic articles, as milk, meat, and cheese, promotes growth and strength. It is easily digested and is a proper aliment in disorders of the intestines, especially in diarrhœa and dysentery. Rice flour of the shops is usually so much adulterated, that for the sick or for the well rice, if needed in the form of flour, should be ground at home. Boiling rice is so apt to remove what little plastic matter it contains that steaming is the best way of cooking it.—*Prairie Farmer*.

SALT WITH OTHER MANURES.

In resuming the subject of "Common Salt as a Farm Manure," we propose to give prominence to the application of salt in conjunction or combination with lime. The suggestion in a "Rural Topic" last week, that an application of salt and lime would probably be accompanied with great benefit to the wheat crop in those districts which had suffered most severely from rust, was held justified by the results of many analyses of soils made by the late Dr. Macadam, those analyses having proved that lime was notably deficient in our best agricultural soils. In the same place the explanation afforded by Berthollet, Way, and Voelcker was also recited of the action of salt in strengthening and brightening the straw of wheat and barley, and thus enabling them to pass unscathed through the ordeal which would otherwise have resulted in their destruction by rust; we need not, therefore, say more on this branch of the subject at persent. There is nothing new in the applicaton of either lime or salt, or of both together to the soil, the practice is a time-honoured one, and was more in vogue formerly in the old country than since drainage has been generally adopted for wet land. Drain first and lime after, is however the proper course of action; by liming wet land before it is drained half the power of the lime is wasted. Lime itself is, perhaps, of the greatest value in altering the mechanical condition of clays and in opening up their great stores of fertilising elements to the crops. On light soils it should be sparingly used, and it must not be frequently repeated; such land very soon gets tired of lime, for each successive application of lime reduces still further the quantity of organic matter in the soil. Mr. C. Johnson, whose essay on salt has already been referred to and quoted from, found that heavy clay and peat soils required the largest proportions of lime; he has used it at the rate of 25 bushels per acre on light soils and up to 100 bushels per acre, but never more than that, on clays. In England it is said never to be used in large quantities, excepting in improving peat mosses, where 1,000 bushels have sometimes been applied with good effect. In Scotland up to 360 bushels are sometimes used upon farm lands, and in Ireland still larger proportions. Lime and peat, in the proportion of one part of the former to three of the latter, were found highly effective in growing a turnip crop. The peat is reduced by the action of the clover to a finely divided state, and rendered partially soluble by the action of the lime, and a most powerful dressing for young clovers. This, it is said, is explainable (amongst other reasons) by the fact that the peat employed being saturated with a solution of sulphate of iron, the lime converted it into sulphate of lime, which is a constituent or direct food of clover. Experiments on light soils with two parts of lime to one of salt in a dry state and allowed to remain for three months in a dry place before being used, were equally successful. An application of from 40 to 50 bushels per acre produced a crop of turnips fully equal to the crop resulting from a dressing of 20 cubic yards of farmyard compost, and on another experiment equal to the crop from an ordinary full manuring with the compost. In reference to mixing lime with a compost-heap, the authority already cited does not recommend it. There is nothing to be gained by the practice, but much harm may be done; "the natural well-regulated fermentation of the dung effects all that the lime can do, and in a better manner; for the lime dissolves, and to a considerable extent decomposes the finer and richer portions of the compost, and it certainly renders the straw and other coarser portions of the manure drier and more difficult to dissolve in the soil. The practice, therefore, seems worse than useless." It should be understood that lime is soon carried down into the soil; 1lb. of lime is dissolved by 480lb of water; the rain, therefore, always conveys it from the surface downwards. The practice of ploughing in this, however, is approved by many, and recommended to some extent by the authority referred to. "On light soils, if it is possible to obtain any ditch or pond mud to mix with the lime, far better effects will be produced than from lime alone. Soils of that description have often been ruined by a long course of liming, and we are of opinion that it would be easy so to ruin a great many of the lighter soils of this country. We have been treating chiefly of lime alone, but we must revert now to recorded experiences of applications of lime with salt. Whilst the duty remained on salt in Britain, sea-water was employed to slack lime; but it was partially boiled down in order to obtain a suitable proportion of salt. As residents near salt lakes may desire to make such use of the water, we note that 3,000 gallons, reduced by boiling to 600 gallons, will slack 64 bushels of lime; the above quantity of water represents about 700lb. of salt, a quantity sufficient for two acres. "Every farmer," observes Mr. Johnson, speaking of England, "has it in his power, even in the most inland situation, to procure this most excellent manure for the use of his farm, by means of a mixture of two parts of lime with one of salt, and suffering it to remain incorporated in a shady place, or covered with sods for two or three months, a plan which I suggested some years since. (*Essay on Salt*, p. 32, 3rd edition.) By this process a gradual decomposition takes place; muriate of lime and soda are formed, the whole mass speedily becomes encrusted with alkali. There is another advantage to be derived from the adoption of this process besides the formation of soda,—viz., that the muriate of lime is one of the most deliquescing or moisture-absorbing substances with which we are acquainted; and in consequence

whenever it exists in a soil, the warmth of the sun has in summer much less influence on it than it would otherwise have." Experimenters with the mixture of salt and lime should attend carefully to the directions, and especially should not use it before decomposition has taken place. It should be allowed to lie for two or three months as directed, and then be applied at the rate of from 30 to 50 bushels per acre, either by broadcasting it, or mixing it with earth and spreading it.—*Australasian.*

COMMON SALT AS A FARM MANURE.

THE recent action of the Kyneton Agricultural Society has given prominence to the subject of the use and value of salt in farm husbandry. Its utility as a condiment will be questioned by few stockowners, but on the committees of some of the agricultural societies are farmers whose experiences have not led them to attach as high a value to the use of salt in wheat husbandry as others have done. That contradictory notions are held regarding the value of salt cannot be deemed surprising by any one who is capable of realising the fact that salt is already present in greater or less quantity in nearly all soils, and that soils differ so greatly in constitution as to render very difficult the task of obtaining correct and definite answers to any questions which the farmer may put to them. The inutility of adding salt to land already surcharged therewith should need no demonstration. There must be a great deal of land in this country that would not be benefited by dressings of salt, besides the land situated near the sea coast. A very simple analysis of the soils within two or three miles of any of the salt lakes in the interior would probably show that a further addition of salt to those soils would be superfluous, and that to the extent of being injurious. It is quite possible also that farmers who have arrived at an opinion adverse to the value and utility of salt have been putting the question to land which, being of a retentive character, has not parted with the saline applications already entrusted to it. Dressings of lime oft repeated not only fail to elicit increased yields, but actually injure certain descriptions, of soil unless well supported also with farmyard manure. It is necessary, therefore, to know before determining to apply salt as a manure, whether the land intended to receive it has need of such stimulant or not. Experiment [illegible] determined that salt [illegible] doses induces a more [illegible] [illegible] somewhat large doses. [illegible] not [illegible] that in positively large [illegible] of a marine char[illegible] [illegible]'s experim[illegible] con-taining from on[illegible] [illegible]olve grains of [illegible] pe[illegible] and [illegible] of water, prove this. In [illegible] solutions [illegible] than 12 grains [illegible] weaker solutions [illegible], except those in [illegible] three grains [illegible] in the solution of one gr[illegible] the [illegible] continued to live at the plants in pure rain-water [illegible] I. was further proved that in a weak solution of salt [illegible] vegetated which died in simple water. "Salt," says Mr. Cuthbert W. Johnson, "renders earth more capable of absorbing the moisture of the atmosphere—a property of the first importance (especially in Australia), since those soils which absorb the greatest proportion of moisture from the atmosphere are always the most valuable to the cultivator." Of its influence upon the wheat crop the same authority says:—"Salt, it should be remembered, *rarely causes the wheat plant to grow larger or taller, but it fills up the ear better*, and brings the weaker plants forward. Mr. Sinclair informs us that 'salt appears to lessen the produce of straw and increase the weight of grain.' Of his own experience Mr. Johnson adds:—'I have never been able in my experiments, nor in any I have witnessed (with salt alone), to observe any increased quantity of straw, even in cases where there was increased produce by means of salt of six bushels of wheat per acre.'" In reference to the amount of dressing and the nature of the soil on which his experiments were conducted, he says:—"The salt should be applied some time before sowing the seed, not less than 10 and not more than 20 bushels per acre." The following statement of the result of some trials in 1820, on a light gravelly soil, will show how important may be the result to the country at large by its judicious application:—

	Bush.	lb.
No. 1. Soil without any manure for four years, gave per acre	18	26
No. 2. Soil manured with stable dung to previous crop (potatoes), gave per acre	26	52
No. 3. Soil with five bushels of salt per acre, and no other manure for four years	26	12

To this Mr. Johnson, in his "Essay on Salt," adds the testimony of "A Plain Essex Farmer." "The soil," says Mr. James Challis, of Panfield, "that I described to you to be rather of a loose hollow description, had a dressing of salt in November after the wheat was sown, about 14 or 15 bushels per acre. It produced at the rate of about six bushels per acre more than that which was not dressed, and it may be stated to be £1 per load of 40 bushels better in quality." This improvement in quality is conspicuously noted in most of the reports furnished to Mr. Johnson. In experimental applications, where the quantity of salt was gradually increased in order to determine at what point it ceased to be beneficial, the plumpness and quality of the grain were maintained even when the yield began to show a reduction in quantity. A Mr. Legrand, who experimented on barley, found that its effects gradually advanced up to 16 bushels per acre, and from thence as gradually diminished to 40 bushels, at which point vegetation was stopped. As a sweetener and improver of grass land, salt is highly spoken of by many. Mr. Collyns, of Kenton, Devon, reporting in 1826 on some farms that he had visited, and in which salt had been used, is found a fine verdant pasturage in what used to be coarse and rushy meadows. On the same farm, where 10 bushels an acre was the regular yield of wheat, the yield was first raised by a dressing of 10 bushels of salt per acre, to 35 bushels, and in the next year, after being similarly dressed, 140 bags of potatoes were produced per acre. Another dressing of 10 bushels of salt to the same land appears to have been an overdose, for he "had not more than 20 bushels of wheat per acre, but the quality was very superior indeed, and the root of clover in it very fine and luxuriant." It is thus possible that the luxuriance of the clover was also a partial cause of the lighter yield of wheat. The same experimenter adds:—"In every field I have salted I find the grass very much superior to any produced before the use of salt." A large number of experiments in potato-growing made by Mr. Johnson, and others by the Rev. Edward Cartwright, show that salt was especially useful as a manure for that crop on the soils in question. The soil which unmanured gave 120 bushels of potatoes per acre, gave after 20 bushels of salt in September, 192 bushels of potatoes; 20 loads of manure gave 219 bushels, 20 loads of manure and 20 bushels of salt advanced the yield to 234 bushels; 40 bushels of salt alone gave 192½ bushels, and the same quantity of salt with 20 loads of manure 244 bushels of potatoes per acre. The Rev. Mr. Cartwright, who tried ten different manures for potatoes, found salt superior to all, except salt and soot; this mixture had a most remarkable effect both on potatoes and on carrots. The subject of salt and its judicious use will be found by those of our readers who have never entertained it, by no means as unimportant as many would have them believe. Salt is as conducive to the health of a great variety of vegetation as to animal life. The subject will be early resumed in these columns.—*Australasian.*

THE CULTIVATION OF ECONOMIC PLANTS IN SOUTH AUSTRALIA.

FROM Dr. Schomburgk's report on the progress and condition of the Botanic Garden and Government plantations at Adelaide, South Australia, a good idea of the capabilities of the colony for the cultivation of [illegible] plants of economic value may be obtained. The introduction into different parts of the world of plants producing fodder for cattle has occupied much attention of late, not only in this country for the purpose of cultivation in India and the colonies but also, it appears, in Australia. Fodder plants generally, whether grasses or otherwise, have been tried in experimental grounds in South Australia, and though the last summer was the hottest and driest that had been known in the colony for some time, it is satisfactory to learn that several kinds withstood the effects of the drought. Chief amongst these was *Panicum spectabile.* During the hottest time the plants grew vigorously, and not a blade was injured by the heat and drought. Dr Schomburgk thinks it cannot be too highly recommended not alone as the best summer grass, but also as a protection against the spread of fire by sowing a strip 12 or 16 feet broad around wheat crops, and as this grass is in its finest condition when the wheat ripens, it would check any fire coming from outward, and after the wheat is reaped there remains a splendid crop of food for cattle and sheep. As it grows only in summer, it is valuable for hot and dry climates. This grass is said to be more easily propagated from roots than from seed, as every little bit grows readily, and produces in the first year plants fit for use, and as it extends rapidly, and by vigorous growth, it is difficult to get rid of it out of the ground. The cocksfoot grass (*Dactylis glomerata*) is also a valuable fodder grass, very productive in consequence of the rapidity with which its leaves grow after being eaten or cut, and possessing considerable nutritive qualities for fattening purposes, is well worth a place amongst cultivated grasses. Of the crested dog's tail (*Cynosurus cristatus*), Dr. Schomburgk says:—"All the domesticated animals, particularly sheep, are fond of the root-leaves, which are produced in abundance. From its forming a close leaf, and having fine foliage, it may be sown on lawns; the drought has no effect upon it." The hard fescue grass (*Festuca duriuscula*) is classed as one of the best grasses introduced into Australia. It seems to thrive in a variety of soils, and from the fineness and bright green colour of its foliage in summer, is strongly recommended for extended culivation. Cattle are extremely fond of it, and it endures well the summer heat. Of broom grasses, *Bromus inermis* and *B. longifolius* are both rich and extremely nutritious, ranking amongst the best of introduced grasses. The bastard millet grass (*Paspalum dilatatum*), although a native of Brazil, keeps green throughout the year and affords a fine food crop *Saccharum cylindricum* is also strongly recommended for its nutritious qualities, and its capabilities of enduring extreme drought. *Pennisetum fimbriatum* and *P. longifolium* both prove to be excellent grasses in dry lands, producing good pasture and good hay, and consequently of high value as fodder plants. *Panicum tomentosum*, although a native of the tropics, appears to endure the drought and heat of South Australia. All

the *Panicums* contain nutritive qualities for fattening purposes. Of the well-known tufted hair grass (*Aira caespitosa*) Dr. Schomburgk says of it:—"Although a rather coarse grass, forming large tufts, it stands our drought uncommonly well; not the slightest effect of the heat and dryness is observable on this grass, and no doubt cattle will become used to it." All the above kinds withstood the effects of the unusally dry summer in Adelaide remarkably well, so that they are considered well adapted for extensive cultivation in the colony. Dr. Schomburgk further says:—"I have given my opinion and advice in former reports, and again mention that it is impossible to stock runs with artificial grass, on account of the large extent of pastoral land, and of the insuperable difficulty arising from climate and drought, to which some parts of the colony, especially the north, are often subjected, so that the squatter must depend on native grasses for his stock, and the only resource for him is to encourage the growth of these. I fear my advice will never be heeded, but the result from wanton destruction of grasses from constant grazing will soon be shown by their disappearance, which must follow. By the practice of grazing the same land throughout the year, and overstocking the grasses, especially annuals and other herbs, are prevented from insuring their reproduction from seed, and as the sheep crop very closely, even the perennial herbs must succumb."

Most of the better kinds of native Australian grasses have no tendency to form a close turf, and as they mostly grow in tussocks, are more easily eaten out of the ground and destroyed. It is apparent that the stockholder must depend on the native grasses, and it is therefore to his advantage to encourage their growth. To carry this out the runs should be divided up; annually one of these divisions should not be grazed to allow of replacing the pasturage. The grasses should grow unmolested—flower, ripen, and scatter their seeds, so as to ensure their reproduction. Such a system of rotation would improve the growth of pasture. By the present system of grazing the runs constantly throughout the year, much injury is done to the native herbage, whilst every encouragement is given to the growth of noxious weeds, which the sheep will not touch, except when pressed by great hunger, and so these obnoxious herbs will gradually increase, and the better verdure must more and more give way every year, the grasses dying out one kind after another, several species, it is said, having been quite lost; and the increase of noxious weeds seems to be proved by the fact that, during the last few years, larger numbers of sheep have been poisoned than formerly. Not only has the fertility of the land been exhausted from inattention to the warnings of science, but diseases—*take-all* and *red rust*—climatical disasters, such as drought and frost, become more prevalent. It is also true that the task of introducing any new economic plant, and with it probably a new industry, is not an easy one. We may know all about the structure of such a plant, its life, its distribution, and its culture, but for our particular purpose we must also know its natural enemies, besides which there is the important question, will the cultivation of such a plant pay commercially, when we have to compete against other countries where wages range lower; and, again, how long will it be before we can derive a profit from its culture. It is no wonder that many shrink from the experiment rather than wait for the lapse of years before a profit can be returned. The former is too much used to the growing of cereals which, no doubt, gives the quickest returns, and, till now, has retarded the cultivation of such plants as require a longer time before a profit can be obtained.

The new fodder plant, known as the "Teosinte"—*Euchlæna* (*Reana luxurians*)—a native of South America, has been introduced into South Australia, amongst most of our other colonial possessions. As its specific name indicates, it is very luxuriant in growth, enormously prolific, easily propagated, and its stems are very tender, and much realised by cattle, possessing great fattening properties. Though it is only quite recently that the *Euchlæna* has attracted so much attention, its value as a fodder plant has been known for some time. In 1872 M. Darieu de Maisanneuve wrote as follows:—"It is a very large gramineous perennial, and very rich fodder plant," for which purpose he considers it has no rival. Each of the plants in the Bordeaux-gardens threw out about 100 shoots three metres long. The tender stems contain a large quantity of saccharine matter, and it is estimated that each plant would supply food for two head of cattle for 24 hours. Reporting on this plant in 1878, M. Rossignau says that in Guatemala it grew in a temperate zone better than in very warm climates. It has been found that it grows most luxuriantly in new moist soil. Cattle fed on it fattened rapidly. The plant is easily propagated by cuttings. In Mauritius, where it has been introduced, splendid results have already been attained from its cultivation. A few seeds sown in dry soil produced enough fodder for two horses a day. The plant can be cut down, and is speedily replaced by young shoots. In New Caledonia, the *Euchlæna* is strongly recommended as a luxuriantly growing plant, and its qualifications as a fodder plant described in terms of the highest praise.

Dr. Schomburgk's experience of this plant in Adelaide is given in the following words:—"I received the seed in July last, and sowed it at once in boxes; it soon germinated, and the young plants showed at once a luxuriant development. As I feared, the season was not far advanced enough to trust them to the open ground, they were planted in 4-inch pots and kept in a sheltered place until the middle of September, when about a hundred were planted in the experimental ground of the park, the soil being tolerably good, having only been dug. The cold weather checked their growth in the commencement, but when the warm weather set in, in October, their development has been surprising. Notwithstanding that after planting, they have never been watered, and considering the great dryness of the season, their growth is vigorous. The characteristic of the *Reana*, in throwing out such a number of stems, is also predominant on our plants. The plants do not, as yet (end of February of present year) show the slightest effect from the injurious drought, the leaves preserving their healthy green, while the blades of all the other kinds have suffered materially, and are burnt. It seems that the *Reana* requires the same cultivation as maize and sorghum. The seed should not be planted before September. Due regard being paid to its enormous development, they should be planted at least four feet apart. It would be premature to predict as yet that the *Reana* is adapted to our (Australian) climate so as to become a profitable summer fodder. There is also another important point, viz., will the plant produce seed, and will it ripen with us, although the plant is a perennial and will last for years. I am in hopes that the plant will turn out a great acquisition to our summer fodder plants. The plant is liable to be mistaken for maize or sorghum, which it closely resembles, and to which it is closely allied, and, like maize, it bears male flowers at the extremity of the stems, whilst the female flowers appear on the stems."

Of the much advertised prickly comfrey (*Symphytum asperrimum*), Dr. Schomburgk gives it as his opinion that, at least to the South Australian plains, the plant is of little or no use. It has been planted in different soils and situations, and suffered much from the drought. The heat and dryness of the country seem to be too much for it. During the winter months, however, the plants made very satisfactory growth, and produced some fine leaves, but in the month of October the leaves began already to suffer, showing the effect of the warm weather, and dried up before any of the grasses, giving not the slightest promise of being capable of producing 80 to 100 tons per acre per annum, the estimated produce of the plains not amounting even to one ton per acre. However prolific the prickly comfrey may be in some climates, it seems not to to be suited to the hot, dry seasons of Australia.

In view of the probable exhaustion of the supply of esparto from Algeria and Spain, it is satisfactory to learn, on the authority of Dr. Schomburgk, that there is every prospect of the plant succeeding in South Australia. Under the head of medical plants we learn that a great demand has arisen in South Australia for *Phytolacca decandra*, which is freely used in the homœopathic treatment of diphtheria, a great number of children, it is said, having been saved from death by the influence of the plant.

A branch of cultivation that promises to become of very great importance in South Australia is the systematic growth of perfume plants. Of the magnitude of the commercial aspect of the perfumery trade, we are reminded that British India and Europe consumes about 150,000 gallons of handkerchief perfume yearly, and the English revenue from eau-de-cologne alone is about £8,000 a year; that the total revenue from imported perfumes is estimated at about £40,000, and that one great perfume distillery at Cannes uses yearly about 100,000lb. of acacia flowers (*Acacia farnesiana*), 140,000lb. of rose petals, 32,000lb. of jasmine blossoms, 20,000lb. of tuberose, besides a great many other fragrant plants. Dr. Schomburgk says:—"Most of the flowers which provide the material for perfumes grow most luxuriantly with us, viz. mignonette, sweet verbena, jasmine, rose, lavender, *Acacia farnesiana*, heliotrope, rosemary, peppermint violets, wallflower, laurel, orange, and the sweet scented geranium. I may say that these plants thrive probably in greater perfection here than in any other part of the world. No doubt South Australia should be a perfume-producing country. We see flourishing here some of the most valuable scent plants, and even some of our native plants will yield a valuable scent; but two things are needed to encourage the enterprise. First, if the scent is manufactured in South Australia, freedom of the still, so as to license distilling in vessels of less than twenty-five gallons capacity, and secondly, the *bonâ fide* advertisement of a capitalist manufacturer that he will buy any quantity of specified flowers, leaves, roots, or plants, at a marketable price, then some farmers might be tempted to plant a few acres of lavender or mint; another, geraniums or rosemary; another, jasmine; whilst plantations in hedgerows, or otherwise of roses, cassia, together with contributions of gardens, would lay the foundation of an export trade. Then it must also be noted that what ever the value which plants yield in flowers, fruit, leaves, and stems, it is increased threefold under manufacture, and this manufacture again consumes other local produce called into existence by it, such as olive and other oils, fats, alkalies, wheaten flour, colouring matter, pottery, and glass-ware, which combine to make the farmer and the manufacturer contribute largely to the maintenance of the population and the wealth of perfume-producing countries." Dr. Schomburgk further points out the profits likely to accrue from an extended cultivation of scent-bearing plants as against the cost of land in England, acres of which in certain localities are under cultivation of peppermint lavender, and other well-known plants of the same class. The failure of these crops, or more particularly those on the farms of Grasse, Cannes, and Nice, would be a serious disaster to this branch of commerce, the importance of which may be proved from the fact that a number of a well-known perfumery house in Bond-street has thought it worth his while to visit Australia for the purpose of encouraging this branch of culture. Regarding the manufacture of the perfumes, an opinion is expressed which will no doubt be fully endorsed by practical men at home, that it is unadvisable to prepare them in the colony; this work would of course be much more effectually done in this country, at the same time, the plants might go through some manipulation, or partial preparation, so as to reduce their bulk and consequent cost of freight. The outcome of this endeavour to

open a new branch of commerce with Australia will be looked with much interest.

The introduction and extended cultivation of the olive (*Olea europea*) in Australia is now un *fait accompli*; it is nevertheless satisfactory to find that a choice variety—that which produces the famous Lucca oil—has been successfully raised. This new introduction seems due to the energy and liberality of a private gentleman, by whom it is hoped the plants will be freely distributed.

Some amount of interest has lately attached to the catalpa tree on account of the great durability of the wood; it is said to resist decay in a marvellous manner, especially when buried in the ground, or placed in contact with the earth; fence posts made of it have stood in the ground forty-six years, and when taken up have shown no signs of decay. Further, a specimen of the wood taken from a post that had stood in the ground for 75 years was perfectly hard and sound, and that part that had been buried showed decay only to the extent of about a quarter of its diameter. The wood is light in weight, of compact fibre, has a handsome grain, takes a brilliant polish, and is well suited for ornamental cabinet work. Trees of four years old have but little sap, and the older ones but a mere film, hardly thicker than paper. They are indigenous in Indiana and other parts of the west, where specimens may be found 4 feet in diameter near the ground, and with trunks 50 feet high without a limb. The trees are of very rapid growth. They should be planted thickly, so as to confine the growth to the stem, and after a certain period thinned out. In the Western States it is being extensively planted, with a view to the future of its timber for railway ties. It is asserted that one rood of land may, in 20 or 30 years, grow trees enough for the owner's use, and at the same time thin out and sell enough of the smaller growth for telegraph poles, fencing, and other purposes, to cover all expenses of growing the tree. The durable nature of the wood is beyond dispute, and from experiments made, thus far, for railway purposes, the catalpa ties proved as firm after a lengthened period under the rails as oak. It is said that a railroad once laid with them would require no renewals to speak of for fifty years, and that in the annual outlay for repairs a very great saving would be effected. It is further stated that in some situations in Pennsylvania the catalpa dies back the first year or often the second, or if not dying right down, it looses its leader, and thus makes the stem crooked. When growing the tree for timber, it is advisable to let it grow, as it will, for two or three years, and then cut it clear to the ground: a clear straight shoot 10 to 15 and even 20 feet high being the result. Trees have been seen that have made a growth 15 feet high and 10 inches round in one season when cut back in this way.

The plant here referred to is undoubtedly *Catalpa bignonioides*, a sample of the wood of which, taken from a post that had remained in the ground 75 years, is contained in the Kew Museum, and to all appearances is perfectly sound and as strong as the first day it was put in. The wood, however, is very even grained, of a very pleasant tint, and would no doubt prove useful in this country for various purposes. Dr. Schomburgk tells us that he has taken steps towards securing a quantity of the seeds of this tree for the purpose of extending its cultivation in Australia. On the subject of wattle farming, or the systematic cultivation of the various species of acacia which are known in this colony as wattle trees, Dr. Schomburgk enters into details, inasmuch as its importance to the colony is such that it formed the subject for the attention of a specially organized commission. The *Phylloxera vastatrix*, or vine scourge, also comes in for a large share of attention, the substance of which, however, has appeared in European journals. The progress made in the Adelaide garden itself is eminently satisfactory, which is shown by the facts of the improvements and enlargements of some of the plant-houses, and the introduction of numerous new plants. It is, moreover, satisfactory to learn that the cost of a new building for the collections of economic botany has been granted by the Government.—*Society of Arts Journal.*

TEA, COFFEE, AND CHOCOLATE.

THE vast array of medical dicta on what we should "eat, drink, and avoid," has recently been supplemented by a curious brochure, "on the moral effects of different articles of food and drink" by Dr. Bock of Leipsic. According to this eminent Professor of Moral Dietetics, the nervousness and peevishness of our times may be ascribed in a great measure to the immoderate use of tea and coffee as beverages, the digestive organs of confirmed tea and coffee drinkers being in a chronic state of derangement, which re-acts on the brain, producing fretful and lachrymose moods. That strong green tea keeps us awake, and excites an abnormal extent of nervous excitement every one knows. Multitudes of university students have ruined their digestion and impaired their nervous system by imbibing quantities of green tea late at night while reading for honours; and Dr. Bock thinks that the snappish and petulant humour of the Chinese is due to their extraordinary appetite for this beverage. But are the Celestials such a very snappish and petulent people? They are obviously very nervous and quick-witted, and in every sense of the term "wide-awake;" yet they bear with exemplary docility and submission the oppression of a Government which rules mainly by the bamboo and the headman's sword. The same in degree may be said of many millions of Russian peasants, who will drink tea by the gallon when they cannot get *vodka*, but who are rather stupidly docile than snappish or petulant. Cobbet's hatred for "the cup that cheers but does not inebriate" is well-known. He loathed tea as he loathed what he called "that hog's food"—the potato. He proposed, indeed, to feed a pig on an infusion of tea, leaves and all, and offered to wager that at the end of a week the animal would expire from inanition. Dr. Bock asserts, on the other hand, that fine ladies addicted to strong coffee are afflicted with a characteristic temper, which he qualifies as "mania for acting the persecuted saint." Such a mania may be prevalent in Germany, where coffee is often drunk with every meal—that is to say, four times a day; but it is happily unknown in England, where, in society, *café noir* is only taken once a day, after dinner. Every Italian physician is nevertheless aware that vast numbers of his countrymen, exemplarily abstemious as they are in the use of alcohol, impair the validity of their brains and the coats of their stomachs by drinking bad black coffee and smoking bad cigars. It is also a fact that the French faculty recognise a distinct malady, brought on by the abuse of coffee, as prevailing mainly among literary men, and several of the associates of Henri Murge, the author of the "Scenes de la Vice de Boheme," who had formed a club from which intoxicants were banished, became patients in the hospital of the Hotel Dieu, to be treated for the malady of "abus due café." In these cases the face and the extremities assumed a livid purple hue, and the disease culminated in apoplexy. Yet, no such malady obtains to any considerable extent among the Turks, who from the rising of the sun to the setting of the same, drink coffee and smoke cigarettes. Their coffee may be said to be eaten as well as drunk, since the roasted berries are crushed, and not ground; the concoction is swallowed "grouts" and all. The Greeks scarcely ever drink tea, but they are nearly as great coffee-drinkers as the Turks; and the Hellenes are really a snappish and petulant people; whereas the Osmanlis are stately, phlegmatic, and somewhat lethargic. Chocolate Dr. Bock considers to be neutral in its psychic effects, and he holds it to be really the most harmless of our fashionable drinks. The doctor might have added that nearly every variety of preparation of the cacoa bean is wholesome, nutritious, and delicious. It is a flesh-former, it appeases hunger, and it enables its consumer to support an unusual strain of fatigue. A Spanish muleteer, or a Mexican arriero, never begins his day's work without a large cup of strong chocolate, and he wants nothing more in the way of a liquid stay or hold-fast except cold water until night. In England an erroneous impression long existed that chocolate conduced to bilious disturbances; but this idea is growing obsolete, owing to the admirable manner in which chocolate is now compounded.—*Ceylon Times.*

MANNILA HEMP.

From G. A. K. HONEY, Esq., Acting British Consul, Mannila, to the Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce.

I HAVE the honor to acknowledge the receipt of your despatch No. 20 of 31st January, and have now to furnish you with what information I have been able to procure regarding the cultivation, *&c.*, of the *Musa textilis*, or Mannila hemp plant.

The plant thrives best in soil largely impregnated with decayed vegetable matter, the districts in which it is planted being to a great extent reclaimed forest lands. Hilly land is the most suitable, the plant yielding more abundantly on such than on low-lying flat ground.

The volcanic nature of the soil of these islands seems to be particularly suitable for its growth.

The climate should be humid, as the trees require a large amount of moisture, and the production is chiefly in the southern districts, where the rainfall is greater. The trees suffer severely during long periods of excessive heat and drought.

The plant can be grown from seed; but the custom here, after cleaning the land thoroughly, is to plant small plants of about three feet high, leaving a space of from two to three yards between each, the young shoots which spring up later round the parent stem filling up the intervening spaces. The ground should be thoroughly cleaned and freed from weeds at least twice a year.

It takes about three years to produce a full crop. In a favourable soil, however, the first crop will be available in about two years after planting, but will only be about one-third of the full production; the second crop the following year will yield about two-thirds; and in the fourth year a full crop will be obtained. The trees are ready for cutting when the first stems are thrown out, and the leaves of the plant, instead of spreading out on all sides, close together. The plants must on no account be allowed to produce fruit, as they then become worthless.

When the trees have matured, or are ready for cutting, they are cut down about a foot from the ground; and the labourer then proceeds to strip off the layers from the trunk, which are cut into strips of about three inches wide, or, say, three strips to each layer. These strips are then each drawn through between a blunt knife and a board, to remove the pulpy vegetable matter from the fibre, which is then spread in the sun to dry. As soon as it has been thoroughly dried, it is ready for the market. The appearance of the fibre depends entirely on the care bestowed in drying it, as, should it be exposed to rain or not thoroughly

dried, it becomes discoloured or assumes a brownish tinge and loses the strength to some extent.

The outside layer also produces a reddish coloured fibre, which is however quite sound and is easily distinguishable from the spoiled hemp.

The cost of preparing and planting a *quinon* (10,000 square fathoms), and keeping it clean up to the time of the first crop, is estimated at $200 to $300, not including the original cost of the land, and afterwards an annual outlay of about $60 would be required to keep the soil free from weeds, &c.

The abovementioned extent of land would produce 30 to 40 *piculs* (140lb. English each), according to the quality of the soil after the plantation is three years old. The labourers here receive, as a rule, one-half of the result of their work, the other half going to the owners of the trees; but owing to the low prices now ruling, they are receiving three-fifths at present, and the owners two-fifths. One labourer working under pressure can clean nearly 20lb. of hemp per diem, but as a rule, the quantity cleaned by one man working steadily day by day, averages about 12lb. At the present value of hemp in the producing districts, each man's half-share would be equal to about 15 cents. per diem allowing for expense of carriage from the plantations to the shipping ports; and this being insufficient for the maintenance of the workmen and their families, the plantations are being neglected in many places, the natives taking to planting maize and other food-plants.

When once planted, the trees continue to propagate themselves, sending up shoot after shoot from the old roots. A plantation will continue to give a good production for from fifteen to twenty years, after which the soil becomes exhausted, and new land has to be planted. There appears to be little or no disease among the trees, which it may be said can only be injured from long continued drought or by hurricanes, the trees being remarkably tender and easily blown over.

The total production of the fibre in these islands last year was 325,600 bales, or 40,700 tons, which is just about the estimated total consumption of the world; and with better prices, the supply could be greatly increased.

As regards machinery, several attempts have been made, but have proved unsuccessful, to invent a suitable machine for cleaning, to supersede the primitive method still in use, which consists of a few cross and upright bars of bamboo, to which are fastened the board and cleaning-knife; the fibre, or rather the layer or strips, being introduced between the board and the knife, which latter is then held down by a string attached to a cross bamboo, on which the foot of the workman is placed, and the strip is pulled through, thus removing all the vegetable matter.

The chief fault of the machinery hitherto tried has been its weight; it being absolutely necessary that it should be light enough to be easily carried about by the workman, and its liability to break the fibre.

A new machine is just reported to have been invented, which, it is said, is likely to prove suitable; but it has not been tried here yet.

I trust the foregoing information may prove of service.

PETROLEUM FROM THE CASPIAN.

A CORRESPONDENT of the *Daily News*, writing from Baku, on the Caspian, gives an account of the petroleum springs existing there. All round Baku the ground is sodden with natural issues of naptha. In some places the earth is converted into a natural asphalte, hard during cold weather, but into which the foot sinks a couple of inches at midday. Add to this that, owing to the scarcity of water, the streets are moistened with coarse black residual naptha. It effectually lays the dust during 15 days. After this period a thick brown dust lies four or five inches deep in the roadway, over which the numerous "phætons" or street carriages glide so softly and noiselessly that the foot passenger is frequently in danger of being run over. When a north or west wind arises, the air is thick with impalpable marly earth, combined with bitumen. The least glow of sunshine fixes this indelibly in one's clothes. No amount of brushing or washing can remove it.

The shores of Baku bay north of the town trend towards the east, and some five or six miles distant are the petroleum, or, as they are termed, the naphtha springs. The surrounding district is almost entirely destitute of vegetation; and in its midst are some black-looking brick buildings, interspersed with curious wooden structures, twenty feet high, resembling continental windmills. These latter are the pump or well-houses covering the borings for oil, and in which the crude liquid is brought to the surface. All around smells of petroleum, and the ground is black with waste liquid and natural infiltrations. Boring for naptha is conducted much in the same manner as that for coal. An iron bit, gouge-shaped, is fitted to a boring bar, eight or ten feet in length, which is successively fitted to other lengths as the depth of the piercing increases. This depth varies from fifty to one hundred and fifty yards, this difference existing even at very short horizontal distances, sometimes not over forty yards. Layers of sand and rock have to be pierced. It is in the sand that often the greatest difficulties have been met with. A loose boulder will meet the boring tool and, displacing itself, leave the passage free. But when the rods are withdrawn to allow the introduction of the tubes which form the lining of the well, the boulder falls back to its place, and baffles all attempts to continue the orifice. This boulder difficulty is the great terror of those commencing to bore. Sometimes, after a lengthened discharge of heavy carburetted hydrogen, the naptha rises to the surface, and even flows over abundantly, as in the case of the artesian well. Under ordinary circumstances, it has to be fished up from a considerable depth. The boring is generally ten, or at most eighteen inches, in diameter. A long bucket, or rather a tube stopped at the bottom and fifteen feet in length, is lowered into the well, and drawn up full of crude petroleum, fifty gallons at a time. This, which is a blue-pink transparent liquid, is poured into a rudely constructed, plank-lined trough at the door of the well-house, whence it flows by an equally rude channel to the distillery. The distillation is conducted at a temperature commencing with 140 degrees Centigrade, much lower, I am told, than the first boiling point for that from Pennsylvania. When no more oil comes over at this heat, the result is withdrawn and the temperature increased by ten degrees. This second result is also laid aside, and the heat being again increased, a third distillation is carried on until no further easily evaporated liquid remains. This last is the best quantity of petroleum for lamps. That which preceded it is the second quality; and the first, or highly volatile, liquid is either thrown away or mixed with the best and second best as an adulteration. The thick dark brown treacly fluid remaining after distillation is termed astalki, and is that used for the irrigation of the streets. This distilled petroleum, if used in lamps, would quickly clog the wick with a carbonaceous deposit. Previous to being offered for sale, it is placed in a large reservoir within which revolves a large paddle-wheel. Sulphuric acid is first added, and after being allowed to settle, the clear topdiquor is drawn off, and similarly treated with caustic potash. After this it is ready for sale. Up to the present the residues, after the acid and potash treatments, have not been utilised. I have no doubt but that later on, valuable products can be derived from them. With the astalki, or remnant after the first distillation, it is different. For years past it has been the only fuel used on board the war ships and mercantile steamers of the Caspian. At Baku its price is only nominal, vast quantities being poured into the sea for lack of stowing space or demand. In cooking apparatus it is used, and for the production of gas for lighting purposes. In the latter case it is allowed to trickle slowly into retorts raised to a dull red heat, pure gas with little graphite being the result. Weight for weight this waste product gives four times as great a volume of gas as ordinary coal. By distillation at a high temperature and treatment with an alkaline substance, a product is obtained which is used as a substitute for oil in greasing machinery.

Apart from the local use of petroleum for lighting purposes, and its exportation for a similar use, comes its application to steam navigation. With the old-fashioned boilers in use, having a central opening running longitudinally, no modification is necessary for the application of the new fuel. A reservoir, containing some hundred pounds weight of the refuse (astalki), is furnished with a small tube, bearing another at its extremity, a few inches long and at right-angles with the conduit. From this latter it trickles slowly. Close by is the mouth of another tube, connected with the boiler. A pan containing tow or wood saturated with astalki is first introduced to heat the water, and once the slightest steam pressure is produced, a jet of vapour is thrown upon the dropping bituminous fluid, which is thus converted into spray. A light is applied, and then a roaring deluge of fire inundates the central opening of the boiler. It is a kind of self-acting blow-pipe. This volume of fire can be controlled by one man by means of the two stop-cocks as easily as the flame in an ordinary gas jet. This I have repeatedly witnessed on board the Caspian steamers. As regards the expense, I give the following data on the authority of a merchant captain who has used naptha fuel for years. His steamer is of four hundred and fifty tons, and of one hundred and twenty-horse power. He burns thirty poods per hour of astalki to obtain a speed of thirteen nautical miles in the same time. One pood is about thirty-three English pounds (16 kilogrammes), and costs on an average from five to six pence. Thus a twenty hours' voyage at full speed for such a vessel costs about twelve pounds sterling. The fuel is as safe and occupies much less space than the amount of coal necessary to produce a similar effect, not to speak of the enormous difference in price and the saving of manual labour. Two engineers and two stokers suffice for a steamer of a thousand tons burden. With the immense supply of natural petroleum, as yet only very slightly developed, and its application to the already guaranteed railway from Tiflis to Baku, and to the inevitable future ones beyond the Caspian over the plains of the far East, I think this subject is worthy of every attention. Yet there are proprietors of large tracts of petroleum-bearing ground whose capital rests unproductive because of a want of demand. The island of Tchilican, not far from Krasnavodsk, teems with the precious liquid. The seaward cliffs are black with its streams flowing idly into the sea; and a natural paraffin, or "mineral wax," is found abundantly in the island and in the low hills a hundred versts west of Krasnavodsk. All round Baku the ground is full of naptha. In hundreds of places it exhales from the ground and burns freely when a light is applied. Only a couple of months ago the volatile products produced a remarkable effect a couple of miles south of Baku. A large earth cliff fronting the sea was tumbled over, as by an earthquake shock, and, as I saw myself, hugh boulders and weighty ships' boilers were thrown a hundred yards. In some places I have seen fifty or sixty furnaces for burning lime, the flame used being solely that of the carburetted hydrogen issuing naturally from fissures in the earth.

"ABYSSINIAN" TUBE-WELLS.

By Robert Sutcliff.

THE process of obtaining water by digging wells is of great antiquity, and that of boring scarcely less ancient. The particular method of obtaining water that is the object of this paper to explain, is entirely modern. The crude idea of driving a tube into the ground for water is scarcely more than a dozen years old, and many of the appliances for driving tube-wells are still more recent. In ancient days, wells were national property, and battles of possession have been fought over them. Now, a well can be made in many places in a few minutes, and the very deserts may be tapped, and clear springs obtained from them. Like many other clever inventions, the tube-well owes its first existence to America, although it has been jocularly claimed as having been really originated by the Negroes, who drove pointed bamboo canes into the earth, and slaked their thirst by drawing up the water through the pores of the cane. Be this as it may, the first iron tube-wells could only be driven in the very softest soils, and the tubes were struck on the head, which caused bending, injury to the screw threads, and fracture of the pipes. The pipes at first employed were also of inferior quality, such as are used for gas purposes, and were quite unsuited to the rough treatment and vibration that a tube-well is subjected to. Upon the introduction of the patent into this country, the necessity for an improved method of driving the tubes became at once evident to those having charge of the invention.

This process it may be of interest to describe. In the first place, the materials used must be of the very best quality, and especially tough and good iron is required for the tubes. The first tube is pointed and perforated up for a few inches, with holes varying from one-eighth to quarter inch. The point is somewhat bulbous, but only sufficiently so to make clearance for the sockets by which the tubes are connected together. On the tube a clamp is fastened, provided with steel teeth, so as to grip the tube. This clamp is tightened by means of two bolts. Next, a cast-iron driving weight or monkey is shipped on to the tube above the clamp. The tube thus furnished, is stood up perfectly vertical in the centre of the tripod; ropes are made fast to the monkey, and driving is commenced by two men pulling the ropes, and allowing the monkey to fall on the clamp. It is particularly important that the bolts of the clamp are kept tight, so that no slipping takes place. When the pointed tube has so far penetrated the earth that the clamp reaches the ground, the bolts are slackened, and the clamp raised again some two or three feet. Length after length of the tube is thus driven into the earth, being connected together by socket joints. It will be noticed that the tube-well proper is therefore self-boring, and that no core of earth is removed.

One of the first questions that will suggest itself to a thinking mind is, will not those small perforations be blocked entirely up by being thus forcibly driven through the earth. This was the American's first idea, and he provided a sort of sleeve, in the shape of a sliding tube over the perforations, to protect them from the earth. Experience, however, has proved this protection to be quite unnecessary. The perforations are made about four times as numerous as is necessary for obtaining a full flow of water from the tubes. Earth does find its way into the tube-well in pellets, like the casts from a worm; but some of the perforations are always left sufficiently open to allow water to pass into the well, and if the soil comes rapidly into the tubes, it is easily mixed with water poured down from the surface, and drawn up by ½-inch tubes, to which a pump is attached. To thoroughly clean and open the perforations, an ingenious contrivance has, however, been utilised. Long before the tube-wells were invented, a pump was manufactured that, by lifting the handle, would allow the water to run out of the tail-piece, and thus prevent freezing in winter. This sudden liberating of a column of water that is maintained above its normal level, is the method which is employed to clear out the perforations of a tube-well. In skilful hands, the water can be kept in a state of agitation, being alternately allowed to press through the perforations, from the inside and from the outside; and before the whole column of water has descended to the level of the spring, it is caught up by the pump, and a fresh supply drawn into the tube. In this way the perforations are syringed, as it were, free from all soft obstructions, and the excess of holes over what is required, makes the closing of a few by grit which is too large to pass through, of no consequence. This action of the pump is not only useful in clearing the perforations, but in some soils it plays a most important part in the development of a supply. When all the holes are free, the fall of the column causes jets of water to disintegrate the earth, and by this means the finer and softer particles are pumped to the surface, and either an actual cavity is formed below, or, in gravel, a sort of filter bed is left, out of which all the sand within reach of the pump has been withdrawn. It should be stated that the first presence of water in a tube-well is ascertained by an ordinary plumb-line, which is also useful for gauging the quantity of earth in the tubes. Having got the tube-well into the spring from which it is to draw the perforations all free, and the earth thoroughly disintegrated in the immediate neighbourhood of the point, it remains to describe the method of pumping.

Until this plan of obtaining water was discovered, all pumping was done by means of a suction-pipe communicating with the well or bore-hole. As the atmosphere had free access to water in the well, the action of the pumps was simply to draw water out of the reservoir, and there its duty ended. The method of pumping a tube-well is entirely different; all atmospheric pressure on the water in the tubes is removed at each stroke of the pump, and hence the supply is drawn to the spot, instead of simply flowing there by gravitation. Although the tube-wells achieve this result as it were by accident, the importance of the fact is now generally acknowledged by engineers. Many engineers were of opinion that it would be impossible to obtain water at all, if the atmospheric pressure were excluded from the well, but they did not pursue their reasoning quite far enough. It is true there must be atmospheric pressure somewhere on the water that we pump from, but it need not be in the immediate vicinity of the well. Perhaps it is miles away. Pumping in this way, we have not the tiny reservoir of an artificial well, but in some cases natural underground lakes,—one might almost say seas of water,—to draw from. Some here may recall how our army, during the Abyssinian war, was supplied with water by those tubes, and it was the prominence which that war gave to the invention that led to the present prefix to their name. For campaigning purposes the wells were only used singly, as one or two were found sufficient to supply the wants of a number of troops. When, however, large supplies for manufactories, towns, and villages were needed, a fresh development in the system took place. Instead of single wells of great diameter, groups of moderate size were driven and coupled together by horizontal mains, so that powerful steam pumps could draw from many wells at the same time. The great friction that would be caused by drawing an enormous body of water to a single spot is thus avoided. Wells so coupled draw from a very large area of ground, and the water-level at any one spot is not so rapidly lowered. The very action of the pump, too, in drawing the water to the wells, opens and maintains channels of communication which help to keep up the level of the water. In putting down plant for a large supply of water a trench hundreds of feet in length, and some two or three feet in depth, is dug, and tubes are driven every twenty feet, and coupled by mains as already described.

It may be interesting to refer to some particular instances where large supplies of water are thus obtained. At West Thurrock, in Essex, a cement company is pumping from two 5-inch tube-wells, about 80 feet deep, 220,000 gallons per day of 10 hours. Another cement works at Northfleet is pumping 60,000 gallons per day. These have been pumped daily for about four years, and still give a constant supply. As expense is an important feature, it may be mentioned that the cost of these did not exceed £60 each. The coupled tube-wells are to be found in greatest numbers at the centres of beer manufacture, where abundance of pure and cool water is an absolute necessity. At Burton-on-Trent about two million gallons are pumped daily from these wells.

A feature of particular interest to this Congress is the question of purity of water-supply. Tube-wells very soon attracted the attention of sanitarians, from the fact that, being forcibly driven into the earth, there is little or no possibility of their being contaminated by surface drainage. Too frequently a dug well, from defective steining or other causes, becomes little better than a cesspool. It is also often expensive work to dig through water which is impure, in search of pure springs below, and still more costly when the good water is found, to keep the bad from mixing with it. Accidental and temporary contaminations are not infrequent in dug wells. One of recent date came to the author's knowledge, which was of so serious a nature, as to cause a Government inquiry. It was found that in a certain district, supplied by a water company, enteric fever was raging with great virulence. No less than 352 cases occurred in places supplied with this particular company's water. In a very exhaustive report to the local Government Board, it was clearly proved that a contamination of the wells, caused in a peculiarly offensive and direct way, was the origin of the epidemic. The instances of tube-wells having been driven through contaminated water, and tapping pure springs below, are very numerous. A few may be mentioned, where the results are not merely one of opinion, but are proved by analysis. At Gravesend, within a stone's throw of the Thames, a 2-inch tube was driven through contaminated water, and reached a spring at about 50 feet, from which a sample was taken, and submitted for analysis. The analyst, after enumerating the particular constituents of the water, pronounced it to be the purest he had ever analysed, with the exception of Loch Katrine. Bear in mind that this was taken from a well situated in the last place one would expect to find pure water, namely, within a few yards of the River Thames, which at that point is quite salt, and charged with London sewage. A point has sometimes been raised, as to whether water obtained from such positions is likely to remain pure when regularly drawn from, and perhaps severely taxed. This particular well has been made between four and five years, and subsequent analyses have proved the maintenance of its good qualities. It is used for purposes which necessitate a very strict watch over its excellence. The ships at that port fill their store tanks from this well, the Royal yacht among the number, the quality of the water is not therefore taken for granted.

At Deal, another illustration of the perfect isolation of a spring was afforded. Most of the wells in that neighbourhood are brackish, and a supply of fresh water was needed for a flour-mill and for domestic purposes. Within the first 25 feet water was found in gravel, but too salt for use. The miller was under the impression that if the tubes were driven deep, fresh water would be obtained, and he discouraged any further testing of the water on account of the delays in so doing until 100 feet had been driven. At 117 feet the pump was again applied, but instead of being better, the water was as salt as brine. The engineer having charge of the work noticed

that at the depth of 45 feet the water level differed both from that at 25 and that at 117 feet, and the fact suggested to his mind the desirability of testing the quality of this middle spring. A second tube was therefore driven to 45 feet, and from it quite fresh water was obtained. This happened five years ago, and the water still remains free from brackishness. Hundreds of other instances might be mentioned, but these are so marked as to be sufficient for the purpose of illustration.

Some waters of good quality, but containing sulphate of lime, &c., are much injured by the exposure they get in ordinary wells, and the author has heard of dug wells at Burton-on-Trent that emit an unpleasant effluvia, and get unfit for use if not constantly pumped. This appears, therefore, an additional reason for keeping the atmosphere from the spring.

When rock, solid stone, or incompressible clay is met with, a tube cannot be driven through it without first making a hole, and removing the cores. In some cases, however, there may be many feet of loose earth which can be easily driven through; this (especially if gravel has to be passed through) is a tedious process. The tubes, therefore, may be fitted with a temporary hard wooden point, which will allow them to be driven through the soft earth, and when an obstruction that cannot be penetrated is met, the point is knocked out, and, being wood and in sections, it floats to the surface of the water, and leaves an open-ended tube, through which ordinary boring tools can be passed to chisel and break up the rock. A tube can frequently be driven through gravel and clay to a depth of, say, 70 feet in a single day. To bore to the same depth in similar stratum frequently takes ten days or a fortnight. The saving that may be effected by driving through the loose stratum can, therefore, be readily appreciated, and, what is still more important, the upper part of the tubes are fixed more tightly in the ground than if a boring had been made to receive them. In some cases, however, hard strata come right to the surface, and the boring operations, consequently, cannot be deferred. When this is the case, instead of using a pointed tube, an open-ended steel shod pipe is driven into the hole as the boring proceeds. As the tools pass down inside the pipe, they do not cut so large a hole as the outside circumference, and some little trimming down of the sides is left for the steel shoe to perform.

In great depths the single tier of pipes, with which the work is commenced, cannot be forced the whole way. Tubes, therefore, of smaller diameter are inserted; but as to pump by the tube-well method, air-tight joints are absolutely necessary, the final tube is continuous from the deep spring to the surface. In this way, tube-wells 300 and 400 feet in length are put down, and if the spring, when tapped, rises to the surface, or within, say, 25 feet of it, only an ordinary lift-pump is required to obtain the supply. Where the water does not rise to the required height, a deep well-pump can be lowered into the tube-well, and worked by rods from the surface.

Bored tube-wells are frequently put down in sets, and connected by horizontal mains, where larger supplies are required.

The new water-works at the town of Skegness, in Lincolnshire, will be supplied by two bored tube-wells thus coupled together. These wells are already completed, and a supply of pure water from the sandstone has been obtained, although salt water was passed through during the upper portion of the work.

In describing the method of driving tube-wells in the commencement of this paper, mention has not been made of the latest system, which is more particularly applicable to tubes of large size. It is so simple as to merit a brief notice. An elongated cylindrical weight passes down inside the tube, and the blow, instead of being struck at the surface, is delivered where it is wanted, near the point which penetrates the earth. As water in the tube would impede the force of the blow, the first socket above the perforations is made sufficiently long to admit of a stout iron ring or washer being placed in the centre of it, in such a way that the two lengths of tube, when screwed tightly together, but against it, one on the under and the other on the upper surface. The interior of this ring is of sufficient size to allow the water to pass freely through it, but it has a screw thread cut throughout its whole length. During the operation of driving, the opening in this ring is closed by a steel plug, which is screwed down into it until its shoulder butts on the ring. The upper surface of the plug forms an anvil on which the driving weight falls. The plug is readily removed and brought to the surface when the required depth has been reached.

The object of this paper has been to describe a particular method of obtaining water in large quantities, and free from contamination; but in the great question that this Congress is considering of National Water-supply, no one system can, under all the varying circumstances, be applicable. One town may have abundance of good water at its feet, others may have to seek it and conduct it from a distance.

The collection of full information on this part of the subject is of the greatest interest and importance, and before a really national scheme of water-supply is entered upon, it seems advisable that a complete hydro-geological survey of the whole country should be carried out.

Mr. Joseph Lucas has, for sometime past, devoted special attention to this branch of geology, and has, single-handed, mapped out certain districts, and compiled much information into a compact and useful form. To carry out such a gigantic inquiry in a reasonable time, however, requires more assistance than a private individual can generally command, and probably it is in this direction that Government aid might, in the first instance, be most advantageously directed.—*Society of Arts Journal.*

WATTLE BARK: ITS CULTURE AND CONSERVATION.

A VERY full and interesting collection of papers connected with this product, has just been placed by Government at the disposal of the Press, from which we learn that a board of duly qualified persons were appointed by the Government of Victoria, in January last, "to consider and report upon the subject of wattle bark, and whether the indiscriminate stripping of the trees, caused by the increasing demand for bark in continental and English markets, in addition to the requirements of Victorian tanners," was likely to exhaust the supply available, by wholesale destruction of the trees producing it, and thus not only to put a stop to exportation for the future, but likewise to cut off the supply required by employers of it on the spot. Passing, however, in the meantime, from further consideration of the long and elaborate report submitted by those inquirers to the Victorian Government, we shall proceed to notice transactions therewith connected, which have taken place more recently and nearer home. On the 12th of June last, a letter was addressed by the Conservator of Forests, Colonel R. H. Beddome, to the Madras Government, in which he reported his opinion on the varieties of Australian acacias cultivated on the hills of this Presidency, and the prospect which exists of their being extensively utilized hereafter. In that letter he pointed out that the *Acacia dealbata* or silver wattle, "is very common all about the stations on the higher plateau of the Nilgiris and Pulneys; it grows very rapidly, but is probably not a long-lived tree, ... for when about 20 years of age, or perhaps a little older, it seems often to decay at its roots and is easily blown down." The *Acacia decurrens*, which he believes to be a distinct kind, though eminent botanists hold an opposite opinion, has not been largely planted like the *dealbata*, but is found occasionally in the Government gardens and private compounds, where it flowers sparingly with dull cream coloured flowers, instead of a profusion of brilliant canary-like flowers. The *Acacia pycnantha* is a very small but ornamental tree, particularly when in flower, which was the case seven or eight years after the seed of it had been sown, but only a very few specimens of it are known to exist at Ootacamund, in the Government and private gardens. The above appear to be the principal acacias yielding tanning bark, but there are three other varieties from which a similar product is obtained, and of which two at least are well known on our hills; more especially the *A. melanoxylon*, found flourishing "most abundantly all over the stations on the Nilghiris and Pulneys." Only a few specimens of the other kinds exist in India, so far as Colonel Beddome is aware, nor does he know whether the *A. penninervis* has ever yet been introduced. All the above trees might, however, be very largely grown, he tells us, on the higher plateaus of the Nilgiris, though "none would have any chance of succeeding in the plains, or at an elevation below 4,000 or 4,500 feet." He questions also "whether the bark would bear carriage to England, and has never heard of any demand for it in this country, but had learned, when visiting Australia seven years ago, that *A. dealbata* and *decurrens* "were largely stripped for their bark, which then realized in England about £5 or £6 per ton." To deliver it now in England from Ootacamund would cost fully as much, if not more, but then "the price has gone up, having more than doubled in the last six years, and is apparently [still] going up." Should the higher value be sustained, "and if we ever have a railway up the Ghâts, it may become a new industry for our hill stations," anticipates Colonel Beddome, whose forecast seems to us founded on a secure basis, as Baron von Müller, the Botanist of Victoria, has stated as the result of experiments made in his own laboratory, that "the dried bark of the *A. pycnantha* yielded 25 per cent. of mimosa tannin," and that he considered it deserving of extensive cultivation; though he apparently gives the preference to *A. decurrens*. Both it and the *pycnantha* yielding a quick return to cultivators of them. The contents of tannin in either kind vary, as far as his experiments have shown, from 18 to 33 per cent., and the price of this in England was from £8 to £11 per ton at the time of his writing; although he subsequently mentioned that the *dealbata*, or silver wattle bark, was in general much less valuable than the black variety, fetching but half its price in the market. Colonel Beddome, himself, does not appear to share the popular belief held as to the high qualities of wattle barks, considering the myrabolans, sumach, divi-divi, and catechu, all of them more valuable tanning agents than they. And as these products can be procured to almost any extent on the plains of India, he questions whether it would pay to rear wattles for that purpose, "at elevations from which the carriage to market would be very heavy, unless the product was very far superior to anything that could be grown in the plains." A more favourable opinion of the wattle has been given, however, by another qualified

reporter, to whom the report of the Victorian Wattle-bark Board was likewise submitted,—namely the Mining Engineer, Mr. R. Brough Smyth, who considers that "the cultivation on the hills of the better varieties of Australian wattles would be remunerative, if the cost of carriage to Madras could be reduced, or if tanneries could be established in the district." Four principal varieties of them are fully established there already, and "these trees seem (says Mr. Smyth) to grow on the hills in greater luxuriance than is commonly seen, except in the most favoured localities of the southern parts of Australia, and under cultivation would probably have a longer life than the average of those in the low lands of Victoria." Numerous suckers, too, spring from their roots, which is a circumstance he had never observed where the wattle was indigenous, and one indicative of their finding themselves quite at home in their new locality. These trees are *not* short-lived, as many reckon them, but will, under favourable conditions of soil, climate, &c., "attain a great height and maintain a vigorous growth for many years." He had seen one place in Victoria well suited to their requirements, in which large groups of those trees had undergone scarcely any change of appearance during 20 years. Poor soils and extreme variations of wet, drought, and temperature, are alike adverse to them, both stunting their growth and inducing premature decay. In the climate of the hills they would, he believes, in all probability thrive well, and consequently yield a large amount of bark." What the *quality* of that yield might prove, however, he was not at present able to determine, and therefore said nothing. Experiments were then being made by chemists for the purpose of settling that point, but the issue of them is not yet within his knowledge. It will, however, be shortly communicated. He suggests that some two tons or more should be stripped, dried, and sent to England for sale, so as to ascertain its true marketable value. There would be no want of a local market for the wood, and the gum also might be collected for export.

In accordance with the various opinions and suggestions above referred to, the Madras Government have directed the Conservator of Forests to collect a considerable amount of bark from their plantations, which is to be sent to any of "the more important tanneries at Madras or Bangalore, the proprietors of which may be willing to experiment with it." And both the Inspector-General of Ordnance and the Commissary-General will be requested to point out how and where the collection so made, can best be subjected to trial in a practical way.

Colonel Beddome is likewise instructed to obtain from Australia the seeds of other valuable varieties of the tanacia, which have not hitherto been brought into this country.

To keep the community informed of all that is being done, Government have wisely and widely circulated their orders on the above subject throughout the Presidency, both to official and non-official persons who have an interest in it; and we are only too glad to supplement their work by drawing to it the attention of such as may not have an opportunity of reading the documents referred to.—*Madras Athenæum.*

AGRI-HORTICULTURAL SOCIETY OF INDIA.

The usual Monthly General Meeting was held on Thursday, the 25th of September 1879.

RAJAH SUTTYANUND GHOSAL, BAHADOOR, *V.P., in the Chair.*

THE proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members:—

The District Engineer, Mozufferpore; Coomar Juggut Sing; Dr. Vincent Richards, and Messrs. F. D. Neish and Arthur C. Showers.

The names of the following gentlemen were submitted for membership:—

J. Gannon, Esq., LaMartiniere, Lucknow,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Baboo Greesh Chunder Mookerjee, Calcutta,—proposed by Baboo Peary Chand Mittra, seconded by Baboo Protapa Chundra Ghose.

The Chief of Kagul, near Kolapore,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

Major G. A. Way, D.A.A. General, Jubbulpore,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

Manager, Darjeeling Tea and Cinchona Association,—proposed by Mr. H. F. Brown, seconded by Baboo P. C. Mittra.

E. P. Wood, Esq., Barrister-at-Law, Calcutta,—proposed by Mr. C. T. Davis, seconded by the Secretary.

The Rev. H. P. Boerresen, Nya Doomka,—proposed by Mr. W. M. Smith, seconded by Mr. R. Bignell.

R. Webster, Esq., Domer, by Bagdogra,—proposed by the Secretary, seconded by Mr. MacLachlan.

Rejoined.—H. E. Thomson, Esq., Superintendent, Government Telegraphs, Akyab; W. S. Mackenzie, Esq., of Jeetwanpore, Tirhoot; and Ernest Newton, Esq., Pleader, Allahabad.

CONTRIBUTIONS.

A glazed case of plants of Araucarias of sorts, &c., and seed of *Panax elegantissima*,—from the Queensland Acclimatisation Society.

Father supply of seeds and plants from the Nicobar Islands,—from E. H. Man, Esq.

A plant of *Acacia arabica* var. *Cupressiformis*, and seedling of *Poivrea coccinea*,—from G. Bartlett, Esq.

Seed of *Eucalyptus gomphocephala*, valuable for timber,—from Baron F. von Mueller.

A small quantity of seed of the "Guango," *Inga pithecolobium saman*),—from Dr. G. H. K. Thwaites.

Seed of the golden millet of the United States,—from Mr. G. Buist.

Mr Buist regrets his inability to send seed of *Catalpa bignonioides* as requested on the suggestion of Mr. J. H. Bridgman. (*See* Proceedings of May last)

GARDEN.

The Head Gardener's monthly report was read as follows:—

Rainfall has been deficient this last month, but has been partly compensated for by the many cloudy days which we have had, during which evaporation was reduced to a minimum. The tank near the principal gate has considerably more water in it this year, than last; this is accounted for by having had drains cut from various low-lying parts of the garden to the tank, alike beneficial to the tank and the part drained. As cutting up the roads makes the garden look unsightly, I shall take the first opportunity of placing large drain pipes under the several roadways as a permanent measure. Works somewhat similar to last month: gootees are being potted off, various cuttings made, general cleaning up of the garden, and delivery orders as brisk as ever. We have planted out a lot of *Araucaria cunninghamii*, each about 5 feet high, and *H. bidwillii* two feet high, in various conspicuous places in the gardens. We have about twenty large plants yet remaining, parts of which I intend to transfer into tubs for specimens. Palms of various kinds have also been planted out in the garden grounds; a couple of large palms have been successfully removed from near the west gate to the margin of the rose garden tank, and placed in prominent positions. Contributions during the month have been a collection of seeds from Botanic Garden and Cape Town, of which some may succeed probably, but I am afraid will not live long, the temperature here being too high. *Bocconia japonica* sown several times, but has not germinated. Andaman seeds from Mr. Man, also 44 pots of unnamed and mixed plants from the same source. Seventy *Persia gratissima* seeds duly sown on day of receipt and covered with wire netting to prevent jackals from scratching them all out. These animals are very troublesome in the garden, destroying seeds, fruits, and any thing they can manage to get at, even digging into the rose beds and cutting off the roots of the roses in their endeavours to make an excavation—with no apparent object. Palm seeds from Mauritius Botanic Garden: these contributions are exceedingly useful. Concerning the germination of mahogany seeds supplied, I find that the Bombay (Gunish Khind Botanic Garden) have germinated 4 per cent., and the Botanic Garden, Howrah, first consignment, 16 per cent. The 10lb. of mahogany seeds subsequently received, roughly calculated to contain about 17,000 seeds, have only produced 15 seedlings.

We have in hand about 200 nice plants of *Phithe Colobium saman* the seed of which was received from the Royal Botanic Garden, Howrah, and which germinated freely; these plants are now suitable for distribution. We have planted out some of the largest for permanent stock.

We have obtained a fresh lot of *Caladiums* by purchase, some of them are similar, to our old stock which were almost exhausted last year by sales: the other section are kinds not in the catalogue, and may be distributed next spring.

Concerning the plants received from Mr. Bull, the following have died up to date, however, I do not expect further losses:—No. 34, Passiflora amabilis; No. 36. Passiflora bijou; No. 45, Peperomia veluteua; No. 105, Chomoea Veitchii.

The remainder are doing well, and will be changed into larger pots, as they have started growth freely.

In respect to the glazed case from Queensland, I find the *Araucaria cunninghamii* all right; *H. bidwillii* only one dead; *A cookii*, 47 barely alive and 92 quite dead; the orchids rather weekly; the *Dendrobium linguaformis* dying soon after exposure to our moist air. The Rajah Suttyanund Ghosal, Bahadoor, of Bhookoylas, has presented to the garden a nice collection of plants, including 37 plants of *Poivrea coccinia*, 6 *Magnolia pumila*, &c.

Remedy for coffee blights, a probable applicability for tea blights.

Read a letter from Messrs. Macneill & Co., enclosing extracts from papers regarding the disease by which coffee plants are attacked, and its cure. "It has occurred to us," observes Messrs. Macneill "that this would probably be as effectual in destroying blight in tea plants, and we purpose recommending it to the Managers of several of our gardens, but as you will see the mode of its application is not very clearly expressed, we would feel obliged if you would be kind enough to ascertain from some one in Ceylon, where you have no doubt correspondents, as full information as possible on the subject."

The Secretary mentioned that he had lost no time, on receipt of the above communication, in sending copies of the extracts to Mr. D. Morris, the Assistant Director of the Botanic Garden at Ceylon, who has been for some time past devoting his attention to a remedy for the *Hemileia*, and requesting as full information as possible in connection with Messrs. Macneill & Co.'s particular inquiry. He had not yet received a reply.

TEA BLIGHTS.

Read a letter from Mr Arthur Grote, acknowledging receipt of a specimen submitted in July last, from the editor of the *Indian Tea Gazette*, and described "as a new form of blight on tea bushes in Assam." Mr. Grote mentions that this is identified by Mr. F. Moore of the Indian Museum, as "a species of *Diapromorpha*, of which genus you sent home another species some 6 or 7 years back. I cannot refer to the proceedings at this moment, but I think Moore called the latter *D. melanopus*, and the beetle now sent is nearly allied to it."

The following is extract from the proceedings of February 1873, of the communication from Mr. Moore alluded to by Mr. Grote:—

"The insect which your correspondent of the Moran Tea Co., Cachar, states attacks and destroys the young Pekoe shoots, is the same species of beetle named *Diapromorpha melanopus*, that cause so much damage on the Cossipore Tea Estate in 1869, as noticed in the Society's Proceedings for November of that year. The only remedy that is at all likely to prove successful is that of having the tea plant carefully and regularly looked over several times during the day, and all insects found upon the plants picked off and instantly killed by pressing them between the fingers. This operation should form a part of the regular daily work of the hands on the plantation."

THE ARGAN TREE OF MOROCCO.

The Secretary submitted a note from Mr. E. C. Buck, Director of Agriculture, N.-W. P., asking for seeds of the "Argan tree," described in the *Gardener's Chronicle* of the 2nd August as a useful oil and food-producing tree of Morocco. "It is stated that seeds have been supplied to various parts of the East Indies. Are you aware whether the tree has been anywhere successfully raised in this country?"

The Secretary mentioned that Mr Scott, of the Royal Botanic Garden, Calcutta, does not remember having seen any plants of this tree (*Elaeodendron argan*) in their gardens, nor can he trace the receipt of any seeds. Not having been able to trace its receipt in any other quarter, he (the Secretary) had addressed Sir Joseph Hoker on the subject, and applied for seeds.

CHOCOLATE TREE.

Read an application from Mr. W. Aitchison of the Dooloo Gardens, Cachar, applying for seeds or seedlings of the cacao or chocolate tree for introduction into his district.

The Secretary mentioned that trees were raised in former years in the old garden of the Society, but they never fruited, and eventually died down. Mr. Scott had informed him that there are now a few specimens in the Royal Botanic Garden, which, though now and then producing flowers, have not as yet borne fruit. Having observed in the last published report of the Royal Botanic Gardens of Peradeniya, Ceylon (see following extract), that the chocolate tree had been successfully cultivated there, he had applied to Dr. Thwaites for seeds as soon as available:—

Chocolate (*Cacao*).—The cultivation of this very useful plant may now be considered thoroughly well established in the warmer parts of the island; the native villagers even are adopting its cultivation to some degree. As an additional number of trees in this garden are now coming into bearing, we shall soon have a larger supply of seeds than hitherto, to meet the considerable demands made upon us for them. In our tropical garden at Hewaratgoda the chocolate tree thrives most luxuriantly, and we have been able to form a small plantation there of the paler fruited Caracas kind, with its cream-coloured variety. Seeds of these we hope to distribute in moderate quantity in a year or two. Our anxiety is to obtain from Trinidad the most esteemed varieties of chocolate in cultivation there. Cultivators of cacao must bear in mind how much the value of the commercial product depends upon the adopting the proper system of fermentation of the contents of the ripe freshly gathered pods, and the subsequent thorough drying of the seeds or nibs."

The Secretary placed on the table farther numerous applications for seeds of the guango (*Pithecolobium saman*) which he had been able to meet partially through the kind assistance of Dr. Thwaites, and hoped to meet fully on receipt of the promised further supply.

GARDEN.

TREATMENT FOR YOUNG FRUIT TREES.

HAVING some little experience in the treatment of young fruit trees, and thinking I might be able to give some new beginners a few points, I write this. I noticed an article in one of the agricultural papers a short time since, in which the writer stated that his trees did best when they were not cultivated. This is entirely contrary to my experience. [Bear in mind that soil and locality have very much to do with this subject. Give fruit trees on this rich virgin soil of the West such cultivation, and they grow so succulent that the first severe winter —and most of them are such there—would kill them limb and body.]

Nor have I been troubled as much with the borer when the trees are under cultivation. And while on this subject let me give my plan of exterminating them. I take a strong chisel, about five-sixteenths of an inch in width, and a mallet. With these you can follow the borer to the heart of a good-sized tree and not injure the tree but little, as the narrow opening made by the chisel soon grows over. Its better than all the knives and is much easier and quicker. My attention was called to the fact that borers are much worse on young apple trees planted near timber land, and after noticing it carefully, I find it is a fact (or has been with me), and I have ceased to remain the trees that die near the woods.

I would advise a new beginner in setting out an orchard, first to chose a level piece of ground; then get the richest land he can, set the trees, at least forty feet each way; cultivate in potatoes or corn, using fertilizers on the crops, unless the land is very rich; seed down in oats and clover in about four years, and break up clover sod after taking up one crop. This for an old land orchard. But the finest way and the quickest way to get an orchard is to cut a piece of woodland (no other woods near for the reason mentioned above). Set your trees right up close to a stump; do not try to line them, but set as close to a stump as possible, and you will soon have fine trees. The stump protects the tree, it moistens and enriches the ground as it decays, and the young trees' roots follow the places made, and thus hang by the old roots. This is the easiest, quickest, best and the laziest way to get an orchard I have ever tried or heard of. In selecting the varieties, every one should try and find out what variety suits his climate, as some apples highly spoken of elsewhere are worthless here.

(A very little salt and ashes thrown close around the trees when set, and once a year afterwards, is a preventive.)—W. F. TALLANT, in *Fruit Recorder*.

FRUIT GROWING BY SMALL FARMERS.

WE know a small farmer who is in pretty close circumstances, having a family of five children—one boy and four girls. He has a small farm sixty to seventy acres—not enough to hire a man, and yet rather too much for a green hand to put into fruit; in fact we would not advise him to plant so largely with the prices of fruits as they are in this section or neighbourhood,—strawberries and raspberries six to eight cents. on an average. This farmer, at this season of the year especially, has hard work to get hold of enough money to meet his daily expenses, and but three to five dollars per day for a few weeks at this season of the year would be a great help to him, and keep things going along nicely until he could realize from his small farm crops. We would add he has horses, wagons, cultivators, hoes, &c., sufficient, so that he has to go to no expense on them, and two to three acres set out to strawberries, raspberries, and blackberries would make but little more work for his horses than if planted to corn or potatoes. Now our advice to this person is to set an acre or two to strawberries and the same to raspberries and black berries—say four to five acres in all, and set only old, tried, reliable market sorts, such as Nicenor or Metcalf for early; Wilson's Green Prolific, Col. Cheney, Chas. Downing and Kentucky, for strawberries; Davidson's Thornless (black) and Highland Hardy (red) for early, and Mammoth Cluster (black), and Turner and Brandywine (red) raspberries, and Snyder, Dorchester, and Kittatinny blackberries. We name these because with him they would be reliable and the plants obtained at low rates.

The whole cost of plants need not be over one hundred dollars for five acres (and this he can buy in time until his fruit comes in to pay). Himself and children can get them all in in one week's time, if the ground is properly prepared. He has well protected, loomy soil in good order, and if set as we shall instruct in our article, "Does it pay" (in next month's No.), he is sure of taking in at least $10 to $20 per day by peddling the fruit in towns around him, and among the farmers even at six to eight cents, per quart. His girls can do most of the picking, while his boy with a little practice can soon learn to peddle them out.

When berries sell from six to eight cents per quart, farmers buy largely, and there is no loss of baskets and but few crates and baskets required, and by having them picked by his own family the fifty to sixty cents, that is paid out is saved to him and to them. With but little experience such kinds of farm crops can be grown, so that the care of such need not take up much time in berry season, and even if it does, he can pay all the help he needs to take good care of such, from his fruit receipts. "But," say our readers, "if a few will pay him, why not go into the business more largely?" Simply because he has to hire the picking done, which takes off twenty-five to forty per cent. of the price he gets, and by having too many with the small facilities he has for peddling, &c., he would have to force them off at even lower prices to get rid of them. Start with the size plantation we name—and then as experience is gained, increase if there is money in doing it.—*Fruit Recorder*.

THE WAR WITH CABBAGE PESTS.

IN old soils especially, cabbage has a tendency to form club-roots, or, as this well-known disease is sometimes termed, fingers and toes. It is a veritable plague which not only occasions wide gaps in the fields, but often destroys an entire crop. The generally accepted belief is that club-root is due to the attacks of the cabbage grub or larva. M. Woronin, who has devoted several years to the study of this disease as it,

occurs in the vicinity of St. Petersburg, calls it "bernia," and says it is produced by a microscopic parasite which develops with greater rapidity in moist than in dry soils. He recommends as a remedy burning the affected roots and changing the crops for a few years.

Farmers in this country have experienced relief from grubs at the roots of cabbage by loosening the earth close to the roots with a hoe, and pouring about the plant one-fourth of a pint of soft soap and water two or three times during the season. The solution consists of one part of soft soap to twelve parts water. Weaker suds poured on top, it is claimed by some gardeners, will destroy the green worm.

A method of preventing the inroads of the cabbage grub is to make each plant unpalatable to the grub. This may be done, according to the *Kansas City Times*, in the following manner. In the spring procure some fresh-burned lime, let it become air-slaked, and mix it with an equal quantity of soot. In planting the holes are made with a trowel in the usual way; each plant is dropped into its place and an inch of soil put over the roots, a good watering given first, then a moderate handful of soot and lime mixture thrown into each hole, and the remaining soil filled in. Equal parts of soot and fine garden soil mixed with water to the consistency of thin mortar with the plants dipped into the mixture up to the base of the leaves previous to planting, is also advised as a preventive to clubbing. Wood-ashes mixed with water poured into the holes has been tried with success.

For cabbage worms Prof. Riley recommends hot water judiciously applied from a watering pot. This must be done with caution, and therefore is liable in careless hands to do more harm than good. Prof. Riley also advises for the same purpose applying repeatedly a solution of whale-oil soap and water, in the proportions of one pound soap to six gallons of water. Pieces of boards raised an inch above the surface of the ground afford an opportunity of examining and destroying once or twice each week transforming larvæ under them.—*N. Y. World.*

FORESTRY.

On the side of the public road not far from Nenagh, stands an old elm tree sadly decayed in the heart. In the cavity is a fine clear spring of water. Pedestrians and visitors drink of the water, and all pronounce its quality cool and refreshing. Three years ago was a very dry summer, and although surrounding springs were all dried up, the well in the tree kept at its usual level. The only hypothesis I can offer for this natural curiosity is that one of the roots acts as a syphon.—*D.S.S.* in *Journal of Forestry.*

There is one shrub growing in Queensland which actually kills men and horses if a certain proportion of their body be stung by it. The curious thing is that the sting leaves no mark, but the pain is maddening, and comes on again and again for months on every change of temperature, such as the body experiences when in bed. Horses become so frantic when stung that they have to be shot, and dogs will gnaw off affected parts if they can be reached. The shrub is not named botanically. It grows from three inches high to fifteen feet. In the old ones the stem is whitish, and red berries usually grow on the top. It emits a peculiar disagreeable smell; but it is best known by its leaf, which is nearly round, having a point on the top, and is jagged all round the edge like the nettle. All the leaves are large—some larger than a saucer. It usually grows among palm trees.

After numerous essays made in the greenhouses of the Jardin des Plantes, Paris, they have been successful in raising numerous plants of a useful tree hitherto almost unknown in Europe; this is the *Gouingamadon*, commonly known as the wax tree of Cayenne. We have no indications of its botanical definition, whether it is one of the wax berry *Myricae*, or a wax palm. It is said to yield a wax similar to that of the bee, and equally applicable. The culture of the tree is not costly, and on arriving at maturity it is said to to yield 50lb. to 60lb. of wax. It is to be tried in Algeria.

The Inspector-General of Austrian railways has addressed a circular to the Boards of Directors of all Railways in the Empire, urging upon them the advisability of cultivating osiers on the waste lands adjoining their lines, both as a source of income, which is by no means to be despised, and as an encouragement to the wicker and basket-work industries of the country generally. He points out that of the 800 or more different kinds of willows with which botanists are now acquainted, there are three in particular, one or other of which would do well on the different soils met with along the course of the lines. These are the *Salix viminalis*, specially fitted for damp ground; the *Salix purpurea*, which does well on dry, sandy soils; and the *Salix pruinosa*, which yields satisfactory results on lands that are almost absolutely barren.—*Farmer.*

MINERALOGY.

GOLD PROSPECTS.

At last the gold prospect industry is about to make a start in Southern India. Not only has a commencement been made in the Wynaad, but a company has started, and, we hear, the full capital subscribed, to open out the Colar fields in the province of Mysore, where the Commissioners have a large extent of land abounding in quartz reefs, and rich with the precious metal. Our readers will, perhaps, be surprised to hear that the capitalists are foreigners—we believe French; and if rumour is correct, is the *Credit Foncier* of France backed with enormous capital. A guaranteed or set-aside amount of five millions has already been placed towards opening out the Wynaad, and they are in treaty, we believe, to buy up the concession of the Colar concessioners. If it is true that foreigners have walked in while English capitalists were sleeping, it serves us right. Many attempts had been made to push the thing in London, when either distrust or disinclination caused hesitation. The terms offered in London has been most liberal, and subject to fair test and trial before concluding a bargain, and now the time has slipped by. We hope to be able to give further and fuller information at some future time.—*South of India Observer.*

Ancient Gold Mines.—We have just had sent to us the following paragraph, cut from a newspaper published in New Zealand:—"A Melbourne merchant received by last mail this curious and trustworthy intelligence of former gold mining on a large scale in India (in the Neilgherry highlands). Speaking about gold and the old native workings, a curious thing happened a short time ago on an estate about ten miles from here, called Harewood. Three planters were out stalking on a grass hill. A valuable dog ran forward and fell into a pit hitherto unnoticed. They were unable to get him out, and one fellow went to the bungalow for ropes, and, to his surprise, found his dog there wagging his tail. No notice was taken of this at the time; but shortly afterwards an opening was discovered on the side of the hill, and it was explored. A large gold mine was found, with air-hold and large pillars of quartz left to support the roof. The reef had been entirely worked out, and thousands of tons of quartz extracted. Further explorations discovered artificial tanks for washing the gold. This must have been hundred of years old—a fact which accounts for the theory that these heavy jungles must have at one time been thickly populated."—*South of India Observer.*

METAL PRODUCTION IN GERMANY.

The statistics of production for 1878 show very favourably in comparison with those of the previous year, considering the depression of trade, which affected Germany not less than other countries:—

	1878. Metr. Tons.	1877. Metr. Tons.
Pig iron	2,124,444	1,956,579
Zinc	94 954	90,362
Lead	84,872	80,278
Copper	9,541	8,862
Tin	831	881
Antimony	1.245	980
Coal	39,420,308	30,428,774
Lignite	10,971,117	10,644,427
Asphalt	47,829	29,735

ANTHRACITE COAL FIELDS.

P. W. Sheafer of Pottsville, Penn., at the Scientific Association, spoke of the anthracite coal fields of Pennsylvania and their rapid exhaustion. He said:—

The work of mining anthracite coal in that State was begun in 1820 with 365; now 20,000,000 tons per annum are produced.

Mr. Sheafer asserted that only one-third of the coal goes into consumptions, two-thirds are wasted, lost in the mines and in preparation. He put the maximum product at about 50,000,000 tons per annum, and at the persent rate of increase this limit will be reached in the year 1900, and in 186 years, say in the year 2065, our anthracite coal fields will be exhausted. Then we must fall back on our bituminous coal area, which reaches the enormous total of 200,000 square miles, say over 400 times the area of the anthracite. Mr. Sheafer said that the competition between our several coal companies, and by them with the bituminous coal, will always keep the prices moderate. He doubted if great Britian could much increase its now enormous product of 136,000,000 tons, yet at her present rate of increase she will exhaust her coal—above 4,000 feet—in about the time in which our anthracite output will cease. But she has not 200,000 square miles as we have in the West.

MINERAL STATISTICS.

THE mineral statistics of the United Kingdom for 1878 have just been issued by the Keeper of Mining Records, Mr. Robert Hunt, F.R.S. The total value of the minerals produced last year was £56,261,494, more than £2,000,000 below the value of the minerals raised in 1877 (£58,398,071). That year already showed a small diminution as compared with 1876, the total for which was £58,691,682; and so low a return as the present has not been known since 1871. Half of the total decrease in the produce of 1878 as compared with that of 1877, is attributed to a diminution in the supply of iron ore, and the greater proportion of the remainder to a decrease in the production of coal. The statistics of coal production given by the Keeper of Mining Records do not, however, always tally with those contained in the reports of the inspectors of coal mines. With regard to the past year there is no noticeable discrepancy; but in 1877 the returns varied from 134,610,763 tons, the figures given by the Office of the Keeper of Mining records, to 132,179,968 tons, the return of Her Majesty's inspectors. The amount of coal which, according to both sources of information, was raised in 1878, exceeded, in amount 132,600,000 tons, and was of the value of £46,412,758. It is needless to say that these values are calculated at wholesale prices. Iron ore to the extent of 15,726,370 tons, worth £5,609,507 was raised. Iron and coal are, of course, the main sources of our mineral wealth, and nothing else approached the amount contributed to the total by these two minerals. The next largest item was furnished by the salt-works. Of salt 2,682,980 tons, valued at £1,341,465, were extracted from mines and springs. The production was 20,000 tons less than in 1877, and the value £150,000 less. There were obtained 77,850 tons of lead ore, of the value (less by 3,000 tons and £400,000 than in 1877) of £804,428; and the clays, for the use of potters, for making procelain, or for the purposes of fire cl y, realised £677,871, at an average rate of about 5*s.* a ton, for 2,711,486 tons. In 1877 the average price was 20 per cent. lower, and the yield a little more. Of tin ore a larger quantity at a lower price was raised in 1878 than in 1877. Last year's return was 15,045 tons at £530,737. The produce of 1877 was 14,142 tons for £572,678. Other figures for 1878 may be more briefly referred to. Sundry minerals, including shales, gypsum, calc, spar, coprolites, and phosphates, realised £512,000 from a production of 778,029 tons. Copper ore decreased considerably in amount (from 73,141, tons to 56,094), and the 56,094 tons raised brought £201,434. Zinc weighing 26,485 tons and worth £80,665 was raised. Barytes produced £35,688 for 22,435 tons; arsenic, £26,900 for 4,991 tons; iron pyrites, £19,099 for 29,867 tons. It will be observed that by far the largest amounts are furnished by the cheapest of the minerals. Silver realised £5,994 from 91 tons 9 cwt. of silver ore. This does not exhaust the yield of silver, for that widely spread metal, which is detected in the waves of the sea, was also extracted in paying quantities from the lead ores. Ochre and umber worth £1,038, and weighing 4,414 tons; manganese estimated at £3,120 for 1,586 tons; nickel ore valued at £616 for 98 tons 18 cwt; fluor spar weighed at 391 tons, and sold for £438; 10 tons of wolfram worth £100, and finally, eight cwt. of uranium valued at £44, complete the list. The ores produced in the United Kingdom turned out 702 oz. of gold, valued at £2,818; 6,381,051 tons of pig iron, worth £16,154,992. 10,106 tons of tin worth £663,080; 3,952 tons of copper, worth £271,042 58,020 tons of lead, valued at £972,491; 6,809 tons of zinc, valued at £128,025. Silver was obtained from lead to the amount of 397,471 oz, and the value of £38,296; from silver ore the amount was 27,648 oz., and the value £6,223. Mr. Hunt observes that as an authority which commands respectful attention has raised the question of the comparative values of the two systems under which the mineral returns are obtained, he feels it necessary to say a few words as to the completeness of the information contained in the annual volume issued from his office, which depends entirely on voluntary returns. Under the Metalliferous Mines Regulation Act, 1872, the inspectors are empowered to compel returns on or before the 1st of February in each year, of all the minerals raised from all mines or underground working. They cannot require returns of mineral produce obtained by open workings or in quarries, such as tin ore obtained by washing alluvial deposits or the [illegible]; and they have no power to seek the quantities of iron ores, or of any other mineral obtained from shallow beds. They are officially unable to give the money values of any of the metallic ores or earthy minerals, or to state (which is more important) the percentage of the metal contained in the ores, upon which their commercial value depends. Each one of these matters will be found fully given in the Mineral Statistics. It is scarcely necessary, he adds, for him to say that nothing can be more satisfactory than the reports of the inspectors, so far as the Acts of Parliament empower them to press their inquiries.

The summary returns of which we have given the heads are founded upon a vast amount of information relating to particular localities and trades, which is scattered through an octavo volume of 215 pages. Some particulars are also given of foreign mineral production. The deliveries of Banca tin in Holland and the sales of Billiton tin in Batavia are noted. The average of the copper standard in Cornwall since 1874 is given. The average has varied year by year, from £97 16*s.* to £119, £115 8*s.*, £103 8*s.*, and £86. Northern Spain entered into the iron ore market to a considerable extent. The export from Bilbao of iron ores last year amounted to 1,224,730 tons. The mean price of coal in the London market for the year was 16*s.* 4*d.*; the mean price at the pit's mouth in Cumberland was 8*s.* 6*d.* This price relates to all coal, not household coal merely. The amount of coal exported from the United Kingdom was 15,494,638 tons, and its declared value was £7,330,474. In 1877 the amount was 15,42[illegible],050 tons, and the value £7,884,485. The result shows lower earnings for more work done. The home trade in coprolites and phosphatic nodules has fallen off. The manure manufacturers now depend chiefly upon foreign supplies. The port of Charlestown, in America, is supposed to supply 170,000 tons yearly, of the value of £500,000; and other places send to the value of £200,000. The English production (the seats of which are in the Suffolk crag; in the upper greensand, with a base of chalk marl, of Cambridgeshire; and in the lower greensand of Bedfordshire) having become of small importance, the returns are difficult to procure. A list of all the mines in the United Kingdom concludes the book. In the production of the [illegible] Mr. Hunt has had the able assistance of Mr. Richard Meade and Mr. James B. Jordan, Assistant-keepers of Mining Records. It continues a series which has been published regularly since 1848, and is of great usefulness for the purposes of comparison.—*Times*.

The Planters' Gazette.

TEA.

THE TEA PLANT.

IS IT A NATIVE OF CHINA, OR OF INDIA?

By H. James Rainey.

AS a separate column of the *Asian* is specially set apart for the discussion of subjects connected with that comparatively recent, but already great Indian industry,—tea, its readers, among whom there are doubtless a large number of Tea Planters, would perhaps not be indisposed to hear a few particulars regarding the history of the plant itself, which I shall put together with the view of endeavouring to establish it to be not a native of China, but of India. I shall, as briefly as possible, state the grounds on which I claim for it an exclusive place in the indigenous *Flora* of this country, and in so doing, I wish it to be clearly understood that I by no means arrogate to decide the question authoritatively and conclusively. I merely wish to raise a discussion on a point of great importance, and contribute my mite towards its elucidation.

Botanists rank the tea plant under the natural order *Ternstrœmiaceæ* or Tea family, and it is known in their binomial nomenclature as *Thea chinensis* or "China Tea." Of the genus *Thea* or "Tea" there is only a single species extant, and this being designated *Chinensis* or "China," the obvious inference is—and as a matter of fact it is intended to signify—that the plant is a native of China. This is what I propose to controvert, and if it can be satisfactorily established that the tea plant is indigenous in India, whilst it is an exotic in China, the scientific appelation bestowed upon it must undergo a radical change, and "*Indica*" be substituted for "*Chinensis*."

In the first place it is necessary to examine the grounds on which it is claimed to have been originally a native of China. The sole reason advanced for it, as far as I am aware, is that it has been cultivated from time immemorial in that country. This much, I think, may be conceded, that the culture of the tea plant and the regular manufacture of its leaves as an article of consumption and commerce, is due solely to the Chinese. Granting, however, both these points, it by no means necessarily follows that the plant is a native of China, though of course the natural presumption would be, in the absence of anything to the contrary, that it is so.

Now let us see, what claim, if any, India has to be considered the native land of the tea plant. First and foremost is the fact that, whereas the tea plant is not found in China save in a cultivated state, it grows wild in many different parts of India. Then, on the other hand, the question arises, did it originally come thence from China? Well, there is absolutely nothing historical, or even legendary, to indicate that it did so; nevertheless, a well-known Indian botanist, Dr. N. Wallich, [illegible]

it as his deliberate opinion that it reached India from China. He explicitly states that "the tea plant originally travelled from the frontiers of China." This was also the combined opinion of "a scientific deputation," composed of Dr. Wallich himself, Mr. Griffith, another well-known Indian botanist, and Dr. M'Clelland, a competent geologist, who were deputed by the Indian Government, at the suggestion of the Tea Committee,* to visit Assam, shortly after the announcement of the discovery of the tea plant there, to investigate the physical condition of the plant with "reference to geological structure, soil, and climate." This scientific expedition proceeded to Assam early in 1836, and with reference to the tea plant, they came to the conclusion that "it was probably artificially introduced" from China. And of course if it was so, India would have no claim whatsoever to be reckoned the native land of the tea plant. It is therefore necessary to examine the grounds upon which they based their belief. They were unable to adduce any fact to support their opinion, and travelled into the hazy region of conjecture to evolve this finely spun-out theory. They stated that—

"It is enough that a single seed may have fallen from a Chinese caravan near the source of one of those fluviatile ramifications which converge to the valley on every side, over 18° long. and 4° lat., where it may have been deposited under circumstances favourable to its growth and propagation. A colony would thus be established, from which thousands of seeds might be annually transmitted, and although ten thousands of these might be lost, still one of them might be drifted during a flood along the banks of a stream, and deposited under circumstances favourable to the establishment of an advanced colony, and so on."

How scientific gentlemen given to rigid inquiry could be induced to enunciate such a far-fetched theory it is difficult to say. The authors of it, however deserving of credit for their ingenuity, cannot be congratulated for having brought forward any tangible argument in support of their contention. Enough to say in refutation of it, that admitting their supposition to hold good with regard to an "advanced colony" of tea plants in Assam, simply for the sake of argument, how did they progress to Tipperah, Munipuri, Sylhet, and Cachar? Thus, I think, it must be allowed that there is nothing whatever to show that the tea plant is foreign to the soil of India. But to the contrary there is something to be urged, and this I shall proceed to state.

In the absence of authentic history we must perforce trust to local tradition, and that the tea plant went from India to China, the following Chinese—mind, not Indian,—legend tends to lend some colour of proof:—

About 516 B. C.—Chinese chronology cannot be depended upon—a devotee from India named Dharma, introduced the tea plant into China, it having been miraculously produced from the hair of his eyebrow, which he had scattered on the ground in a fit of remorse for having permitted the flesh to gain ascendancy over the spirit by sleeping instead of being abstracted in thought. The leaves of this tree he gathered and tasted, and finding that they imparted fresh vigor to his mind, he took the plant to China and made known its wonderful virtues to his disciples there.

Now to explain the significance of the above fable. *Dharma* signifies "religion," and as the tale is undoubtedly an allegorical one, it probably means that the national creed of the Chinese (Buddhism), and their national beverage, tea, travelled in company from India far off, to China.

Fairly balancing the arguments on either side, there is, I venture to think, greater probability that the tea plant is a native of India than of China, and if so, it should occupy a prominent place in the *Flora Indica*, and be re-named *Thea indica*, which new specific designation I would suggest for it.

Before bringing this article to a close, I should state that the honor of the discovery of the tea plant in India (Assam) belongs not, as generally supposed, to either the late Captain Charlton or Mr. C. A. Bruce, but to the brother of the latter gentleman, Major R. Bruce. This, I think, I have satisfactorily established in a contribution to the *Indian Tea Gazette* of May 1877, entitled—"Who first discovered the Assam Tea Plant?" It is unnecessary to go over the same ground here, but I may state shortly that the late Captain Charlton laid claim to the honor on the strength of his finding and making known the tea plant in Assam in 1831, while Mr. C. A. Bruce proved, by the unimpeachable testimony of Mr. Scott, the then Commissioner of that province, that he discovered it at the breaking out of the first Burmese War, which was commenced in 1824. Mr. Bruce, however, candidly says that "his late brother, who was in Assam before the breaking out of the war, had previously informed me of it." This is conclusive, and proves that to Major R. Bruce is due the honor of the discovery, though he never sought for it. *Palman qui meruit ferat.*

It may be added that the tea plant was not discovered in Cachar till 1855, when Kannnath, a Cacharie cooly, found it, although, according to Lieutenant Stewart, it was actually seen by the then Superintendent of Cachar in 1834, who mistook it for the Camelia, which is a barely generically distinct plant. The aforesaid Superintendent is stated to have written to the Secretary of the Committee for Tea Culture in 1834, that in the Cachar district he found "a species of Camelia, the leaves of which had been manufactured by a native from the confines of China into something resembling tea." This was no doubt the tea plant, yet to Kannnath of Cachar the credit of the discovery belongs, and a writer on "Tea Cultivation in India," in the pages of the *Calcutta Review*, Vol. XLI, 1865, says he was at the time of his writing "a blind old man, depending mainly for subsistence on the bounty he receives from the Cachar Tea-planters."—*The Asian.*

* This committee was in 1834 appointed by Lord William Bentinck, the then Governor-General of India, to report upon the feasibility of the introduction of tea cultivation in India, and was composed of eleven members—Messrs. James Pattle, J. W. Grant, R. D. Mangles, J. R. Colvin, C. E. Trevelyan, C. E. Robinson, R. Wilkinson, R. [illegible], G. J. Gordon, N. Wallich, and Radha Kanta Deb.—H. J. B.

It is said by a Hong-Kong paper that efforts are being made to induce the Fohkien tea-growers to import large quantities of tea trees from the best Assam, Darjeeling, Kangra, and Neilgherry plantations, to replace the present stock.

COFFEE.

INDIAN COFFEE.

In the statement of the trade of British India, compiled by Mr. J. E. O'Conor, the following appears under the head "Coffee."

"The exports for the last five years were as follows:—

	Cwt.	Rs.
1873-74	364,420	1,49,14,109
1874-75	311,831	1,30,56,346
1875-76	371,986	1,62,70,267
1876-77	302,489	1,34,53,217
1877-78	297,327	1,33,84,992

The drought in Southern India affected the coffee plantations as well as the fields of food-grains, and would of itself sufficiently account for diminished exports, if the leaf disease and the borer did not help to keep the yield down. The average value per cwt. was a little higher than in 1876-77, having been just over Rs. 45 as compared with 44·4. The United Kingdom and France are the two largest consumers of Indian coffee, although in both countries it is subject to excessively heavy duties,—14 shillings per cwt. in England, and 156 francs the 100 kilos in France when imported direct, an addition of 20 francs being made when the importation is made directly through a European entrepôt. The duty of 156 francs is equal to a rate of £3. 5*s*. 5*d*. per cwt., which is in fact not much short of 100 per cent. on the value of our coffee. The English duty is at the rate of about 15 per cent. *ad valorem*. The United States, with their stupendously productive tariff, show a good example to both England and France in this matter, for the Americans admit coffee in the berry free of duty. I cannot quite understand how it is that a trade with Australia in coffee has not come into existence as yet. The colonies consume large quantities of tea and coffee, but they do not take either the one or the other from India. It cannot be said that they dislike our tea and coffee, and I believe the truth to be that no real attempt has as yet been made from India to open out a trade. Producers in India have hitherto found a ready market in Europe for their whole production, and have had no inducement to essay the opening of a trade with Australia. Nevertheless the trade would certainly become a source of considerable profit to India, and it would be well worth the while of some energetic speculator to direct his attention to the matter. The exhibitions to be held this year at Sydney and next year at Melbourne offer an excellent opportunity for introducing these staples to the notice of the colonists."

COMMERCIAL REPORT.

The statement of the export and distribution of the Coffee Crop for the season is as follows:—

Shipped between 20th September to 30th September 1879:—

	Plantation.	Native.	Total.
1 ship for London ... ... cwts.	679	...	679
2 „ „ New York ...	...	1,287	1,287
1 „ „ Melbourne ...	111	...	111
1 „ „ Mauritius ...	336	...	336
1 „ „ Marseilles ...	209	...	209
1 „ „ Port Louis ...	4,986	...	4,986
1 „ „ Bombay ...	...	219	219
8 ships with ... ... cwts.	6,321	1,506	7,827
Total 1st Oct '78 to 30th Sept. '79 ...	767,293	57,216	824,509
„ „ '77 „ '78 ...	551,046	69,246	620,292
Total cwts. ...	216,247	12,030	204,217
	Increase.	Decrease.	Increase.

Distribution from 1st October 1878 to 30th September 1879.

Places.		Plantation.	Native.	Total.
London	cwts.	688,293	8,548	696,841
Marseilles		11,088	2,808	13,896
Havre		300	5,100	5,300
Trieste		46,140	2,251	48,391
Venice		5,569	6,340	11,909
Odessa		512	...	512
Leghorn		893	1,489	2,382
San Francisco		...	4,500	4,500
Genoa		280	500	780
St. Nazaire		...	4,900	4,900
New York		2,090	9,184	11,274
Mauritius		385	30	415
Melbourne		1,825	600	2,425
Port Louis		4,986	...	4,986
Sydney		288	...	288
Hobson's Bay		1,744	200	1,944
Glenleg		823	103	926
China		1	...	1
Yokohama		1	...	1
Hong-Kong		4	...	4
Shanghai		15	...	15
Calcutta		4	215	219
Madras		—	324	324
Bombay		2,157	10,124	12,281
Total cwts. ...		767,293	57,216	824,509

Ceylon Observer—

COFFEE PREPARATION: THE OBJECTION TO SIZING AND DIVIDING SMALL LOTS.

THE following circular has been sent to the Ceylon merchants and planters :—

30, *Mincing-lane, London, E.C., September* 1, 1879.

DEAR SIRS,—Before the next season for coffee cleaning commences, we think it necessary to direct the attention of your correspondents in India to the loss in value and increase in expenses incurred by the continuance of the system of sizing the small parcels and cherry-dried lots to the same extent as is necessarily done in the earlier and larger shipments. The want of alteration has been pointed out occasionally, but hitherto the reply from the owners of the coffee mills has always been that if they exercised such discretion, they would be open to complaint from the planters that their coffee was not properly prepared. It is as well therefore that the planters should be made fully acquainted with the following circumstances which act, and will continue to act, prejudicially if the present system of sizing these small lots prevails. In accordance with a rule recently passed by the coffee trade in this market, all small lots—cherry pickings, triage, and damaged—are sold separately, when the buyers of large lots absent themselves, and the owners are deprived of a certain amount of competition. It is also well-known that a shipment of 10 to 20 bags of coffee sized into AB, C,PB, and T will bring 3s. to 5s. per cwt. less than if the AB and C were unsized and made into one lot: and should the coffee be sea-damaged, the lots are again divided and expenses increased. For each lot of coffee, whether of 1 bag or 20 bags, there must be a dock warrant with 3s. stamp for every lot at auction, the charge is the same if it be for one bag or twenty bags. And to show the needlessness for such increased expenses, it almost invariably occurs that when these several lots are offered to the buyers, they are bracketed together in order to effect a sale. We may perhaps make it clearer to your constituents by giving an example or two from our own catalogues.

On 24th June we sold as follows :—

Plantation.	Pile.	Bag.	
A	1	1	at 74s. per cwt.
" B	2	1	
" P B	3	1	at 90s. per cwt.
T	4	1	
" T A	5	1	
	6	1	
" T B	7	1	The only sizing necessary was as under.
	8	1	
" T C	9	1	Piles 1 and 2 without mark,
T " P B	10	1	" would be Pile ... 1
	11	1	at 57s. 3 " " ... 2
			4-13 " " ... 3
" T T	12	1	14-17 " " ... 4
	13	1	which would have saved 13 warrant stamps and sale expenses on 13 lots.
" Ch A	14	1	
" Ch B	15	1	
" Ch P B	16	1	
" Ch T	17	1	

The following, taken from our catalogue of 15th July, gives an illustration of the further sub-division owing to the sea damage of the different sizes :—

Plantation.	Pile.	Bag.					
A	69	1	sold at 58s.	"	Pile 75	2	1 at [illegible]
"	70	1	1 at [illegible]		76	1	2nd [illegible] 56s.
	71	1	sd. 8 " 56s.		77	8	[illegible]
					78	1	[illegible]
" B	72	8	" 65s.	" B	79	8	[illegible] 58s.
	73	2			80	1	2nd [illegible] 56s.
	74	1	" 66s.		81	1	[illegible]
" P B	82	3	sd at 70s.	" T 4	88	1	sold at 54.6
	83	2			89	1	
	84	1	sd 2d. 56		90	1	sd. 2d.
" T	85	1	54s 6d.		91	1	" " 56s.
	86	1			92	1	" "
	87	1	sd 1d 56s.				

In this instance it will be seen that the damaged of all the sizes were sold at the same price, and if the A,B, and C had been kept together, and the T and T X also been kept together, as they were sold, there would at the utmost have been ten lots, and the warrant stamps and sale expenses of the remaining fourteen lots would have been saved.

We feel confident that planters must see how much they lose by the present system, and we would suggest that when the coffee can only be shipped in small quantities, the peaberry and triage should alone be separated, and it would further tend to their advantage if, when only a small parcel is ready for shipment, and another would shortly be complete, they would wait till the two could be worked together at the mills and shipped as one lot, unless there be urgent reasons to the contrary.

These remarks apply with equal force to the sizing of cherry-dried coffee, from which it is only necessary to separate the peaberry and triage.—We are, &c.,

C. M. & C. WOODHOUSE.

DISEASE IN THE BRAZILIAN COFFEE PLANTATIONS.

AN alarming account of a disease which has broken out in the Brazilian coffee plantations has been communicated to the Paris Academy of Sciences. The disease appears to attack chiefly the finest and strongest plants—those between seven and ten years old—the evil being most marked in the neighbourhood of rivers and brooklets, and in shady damp valleys. The disease is said to follow the direction of the trees, which are planted in rows, but it occasionally inflicts isolated patches of ground, leaving all round healthy—in the same manner as the *Phylloxera* in vineyards. The symptoms of the malady are thus described:—First of all the tree loses its leaves, and when taken up it is found that the smaller ones—the so-called "hair roots"—have nearly all disappeared, and in the larger roots and the main one the peel or skin is greatly altered. The surface of these latter, as also that of the smaller rootlets left behind in the ground, is covered with small irregular growths, which are burst open at their points. In order to investigate the initial stages of the disease, M. Jobert dug up for examination some apparently sound plants in the immediate neighbourhood of those affected. The roots of these also were covered with small knots which, when broken open, left behind cavities similar to those seen in the dead plants. The interior of these knots was filled with small round corpuscles, which turned out to be the eggs of a minute worm, about one-fourth of a millimetre in length. Each little sac contained from forty to fifty eggs, and the number of knots is such that each tree might easily carry in its roots thirty million worms. As soon as these have left the egg, they make their way outwards, and thus leave the cavity in which they have been developed, exposed to all kinds of external influence, so that the roots at once begin to rot. An extremely damp soil appears to be necessary for their development and further life.—*Home and Colonial Mail.*

IN Western Australia a Company is being formed, called the West Australian Coffee Co., Ld., for the purpose of growing coffee and other tropical produce on the north-west coast of Western Australia in the neighbourhood of Beagle Bay, just abreast of the Lacepede Islands, and it is contemplated to offer a few of the shares in Ceylon later on. Labour will be imported from India, and the Government have promised a bonus to any persons cultivating a *bonâ fide* estate and producing a certain quantity of coffee.—*Madras Mail.*

CINCHONA.

A CAREFUL observer, who has been inquiring among leading cinchona planters in different districts, informs the *Ceylon Observer* that as many as twelve millions of cinchona plants were planted out during 1878 in Ceylon, and that during the present year the number will not be short of thirty millions. Our contemporary remarks:—Taking our estimate as a safe one, of seven million trees of all ages growing in the hill districts at the end of 1877, we should get a total of forty-nine millions at the end of the present year. A

liberal allowance must, however, be made for failures from various causes, and to be quite safe we think twenty-five millions would be a safe estimate to commence next year with trees likely to come to maturity. Planted four by four feet, that number would cover about 9,000 acres of land, but of course the greater portion of the trees now growing are scattered through the coffee plantations." —*Madras Mail.*

CINCHONA CULTIVATION IN TRAVANCORE.

TRAVANCORE in about twenty years has pushed itself to the front and placed itself abreast of the other great centres of coffee cultivation in that one particular enterprise, but has done nothing worth mentioning in tea and cinchona. In spite of the series of bad seasons which of late has visited the coffee estates of Travancore, the planters seem inclined to stick to their work in the hope of better times, which we trust they will experience. At the same time there is no reason why tea and cinchona should not be cultivated side by side with coffee. In the Wynaad tea is found to grow and flourish at about the same elevation as coffee, and this would no doubt be found the case also in the Southern Principality. Both tea and cinchona are even now cultivated in the Government Gardens at Peermade, but merely on a small scale as an experiment or "fad," and is scarcely expected to be remunerative. Enough has, however, been done to prove that facilities for this cultivation on an extensive scale, and on a remunerative basis, exist in Travancore. We are glad to hear that cinchona is likely to occupy a more important position than hitherto, in that State. Sir Madava Row was anxious to introduce the culture of this plant during his *régime*, and took pains to circulate, among those likely to engage in the enterprise, a pamphlet written by the late Mr. McIvor, giving full particulars and instructions on the subject. No private effort, so far as we are aware, was enlisted by these endeavours on the part of the present Dewan of Baroda. But now a cinchona plantation in Travancore, to the north of Peermade, is about to be opened by a gentleman hailing from Ceylon who has had experience of planting in that island, and is now engaged in studying the cultivation of the plant in the Government Gardens at Ootacamund. Young plants of the species best suited to the locality can be easily procured from the Sirkar Gardens at Peermade, therefore with good practical experience, sufficient capital, and patient labour, the new enterprise ought to be a great success. The advantages of free land, so liberally granted to the pioneers of coffee planting, are not likely to be forthcoming in the present case; but we trust the Travancore Government will aid the new enterprise to the fullest possible extent, and thus contribute to render it a source of profit to the planter and benefit to the State.—*Madras Athenæum.*

SERICULTURE.

THE remarkable breakdown in the price of silk continues, and the stagnation of the Lyons market is reported to be so extreme as to amount almost to disorganization. Although the end of September is approaching, there is no symptom of revived activity, and both here and in France mere insignificant orders are forthcoming for the autumn and winter trade. If this lasts much longer, we shall not improbably see a crisis in the silk trade, especially in France, and the weakness of the speculators is shown by the extreme anxiety to realise displayed at Marseilles and the Italian centres,—a disposition which only causes buyers to be more cautious, and to hold off as long as possible. In Chinese silks the demoralization is so great that all quotations are merely nominal, and Japanese silks are in the same bad case.

SILK CULTURE IN THE NORTH-WEST.

A CORRESPONDENT has furnished us with some interesting notes regarding the silk industry in the Gurdaspore district. This industry, he states, has declined somewhat since the lamented death of Mr. Halsey, and several persons who would have been silk-growers had that gentleman lived, have failed to keep silk-worms for want of encouragement and help in the way of advances of eggs, money, &c. The present season has moreover been an unfavourable one; in some instances *all* the silk-worms of a silk-grower have died off, and the yield has not been generally more than half that of an average season. This mortality is ascribed by the natives to the effect of the winter drought on the leaves of the mulberry trees, but it is more probably due to the lateness of the season at which the eggs are hatched. The price obtained for the cocoons is about Rs. 60 per maund for unpierced cocoons, and at this rate there is a fair market; one native gentleman at Umritsur alone having, it is said, purchased Rs. 10,000 worth last year, and he has sent men into the district again this year to effect purchases. An agent of a Bradford firm has also been making pretty extensive purchases, and it is probable that he will buy the late Mr. Halsey's filature at Gajunpore and rear silk-worms in the neighbourhood. The silk industry of the Gurdaspore and Kangra districts is one of considerable interest and importance; and at present, when it may be said to be languishing, every effort should be made by the local authorities to foster and increase it. The extensive purchases alluded to will, no doubt, have a good effect, probably much better than any system of cocoon exhibition and distributions of prizes would have produced, though it is understood that these will be continued.—*Pioneer.*

THE inhabitants of Turkestan cultivate a considerable amount of silk, to which they devote much attention; the cocoons are sorted very carefully, the double ones, badly wound, and pierced ones all going into waste: they form about 15 per cent. of the total production. The reeling is done with a reel of a large diameter, which drives a horizontal spindle; the latter is turned towards the oven in which the cocoons are lying in boiling water. The threads are fished out with a small broom, and generally from eight to twenty-five reeled together. The waste is spun on a hand-wheel, and then washed with a decoction of morels (*Morchella*), which gives to the silk gloss and clearness. This decoction of morels is generally used in Central Asia in silk culture. The morels are dried, powdered, and then boiled in cotton bags. It is the vegetable oil contained in them which acts upon the silk. After being passed rapidly through this decoction, the silk is washed, wrung, and dried. The decoction of morel dyes the silk a light brown tint.

A NEW FRENCH SILK.—Some twelve years ago M. Guérin Menevill introduced into France a large species of butterfly (*Attacus cynthia*) which has made itself at home, and has become thoroughly naturalized, so that it is as large, robust, and prolific as in its native districts,—the north of India and China. One could have noticed in the evenings of the month of June, this butterfly, with wings marked with logitudinal lines, flying in the squares or avenues in the environs of Paris, or even in the city itself, where they are planted with the varnish tree of Japan (*Terminalia vernix*), or in the winter, when the leaves have fallen, one may have observed hanging from the branches long cocoons of a pearl grey colour. These are the winter abodes of the caterpillar which produces the abovenamed butterfly, and are composed of silk. So much has long been known, but little attention was paid to the subject so long as the silk-worm and the mulberry tree both flourished. But of late years so many accidents have befallen both, that the difficulty of breeding the worms has become very great in France, and the price of the raw material has considerably increased. Under these circumstances attention has again been directed to the cocoons of the caterpillar above-mentioned. It is not very rich in silk, is strongly encrusted with glutinous matter, and is difficult to spin. What use has been made of it has been confined to the production of floss silk, a substance of small value. Moreover, as the thread is very fine, it required a special apparatus, and spinners did not appear disposed to risk the expense necessary to work the article.

The mechanical difficulties have now been overcome by M. Le Doux, who has discovered a method of partially softening the cocoon so as to allow it to be easily spun, retaining at the same time sufficient of its natural glue for the threads of several cocoons to adhere together and form one single thread when twisted. M. Le Doux has laid before several of the scientific societies of France samples of the substance he produces, and they were considered as of a very satisfactory nature.

One point especially in their favour is that they can be prepared with the implements now in ordinary use, and consequently no unusual expenditure is required. As the insect is very hardy, and does not require careful tending as the silk-worm does, this discovery is likely to be a valuable addition to French manufacture.—*Western Star.*

THE AILANTHUS AND ITS SILK-WORM.

IT has often been remarked that the *Ailanthus*, or Chinese "Tree of the Gods," is specially fitted for restocking woods and forests, especially on poor soil, which it affects by preference, and which it enriches, and so prepares for further cultivation by the fall of its abundant foliage. The wood, too, is extremely valuable for building purposes, and for use as railway sleepers, resisting the action of damp in a remarkable manner. Besides this, it grows with great rapidity, and is very easily propagated by seeds or cuttings. But the particular value of the *Ailanthus* is found in the silk-worm which frequents it, the *Attacus cynthia*, introduced into France from China some twenty years ago. This silk-worm has now become quite wild and hardy in its new home, thriving well without the least care or attention, and spinning its cocoons upon the *Ailanthus*, whence they may be had for the mere trouble of gathering. The great difficulty hitherto has been in winding off the silk from them, in consequence of which it could only be employed in flock silk, which is of but little value. A process has now been discovered by M. Christian le Doup, by which these cocoons can be wound off, without the least difficulty, on the ordinary apparatus used for other varieties, and the produce of the *Attacus cynthia* is now likely to form the staple of a highly remunerative industry. Very fine specimens of the silk wound by M. le Doup's process, were exhibited at recent meetings of the Paris Acclimatisation Society, where they attracted general attention.

Registered No. 353.

THE

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA: MONDAY, 1st DECEMBER 1879. [No. 12.

NOTICE.

The INDIAN AGRICULTURIST *will be supplied to all Schools and Missionaries in India at half price.*

R. KNIGHT.

Calcutta, 1st Feb. 1876.

CONTENTS.

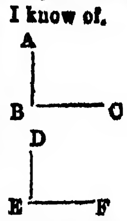
NOTICE TO CORRESPONDENTS.

Our Correspondents and Contributors will greatly oblige us if they will take the trouble, where the returns of cultivation are stated by them in Indian weights and measures, to give their English equivalents, either in the text in parenthesis, or in a foot-note. The bigah in particular varies so much in the different Provinces, that it is absolutely necessary to give the English value of it in all cases. It would be a great reform if the Government itself followed the same course in all the official reports published by it.

CORRESPONDENCE.

MEASURING THE HEIGHT OF TREES.

SIR,—In your valuable journal of the *Indian Agriculturist* for the month of August, I saw a sketch with explanations, for measuring the height of trees, which to my opinion seems rather intricate than the one I know of.



AB is the tree, or any object of which the height is required; measure BC, its shadow on the ground; now take a stick of which DE, its measurement is known, and measure its shadow EF. Now by the simple rule of three EF : DE :: BC : AB, the required height.

The stick is to placed perpendicularly, and the shadows measured at the same time.

S. JEVANJE.

Palmore, August 16.

NOTE.—This letter got unaccountably mislaid, and should have appeared two months ago.—ED., *I. A.*

TEOSINTE SEED.

SIR,—I noticed in the September number of the *Agriculturist*, a correspondent inquiring for seed of the *Reana luxurians* (Teosinté), I shall be very glad to send by post a small packet to any one who cares to try, it. As a forage plant especially for a single cutting, it is no doubt by far the heaviest cropper ever introduced.

A. STORMONT,
Superintendent, Khandesh Farm.

3rd November 1879.

THE CHAULMUGRA PLANT.

TO THE EDITOR.

SIR,—In a letter published in your paper of last month, Mr. J. de Mello Sampaio, Captain of Engineers, in the Portuguese Army, goes to contradict the statement of Mr. John R. Jackson who, in a lecture on "Indian plants adapted for commercial purposes," stated in common with almost all botanists, that the *Gynocardia odorata or chaulmugra* tree is a native of Pegu, Tenasserim, and other parts of the Malayan Peninsula, extending as far as Assam, Khassia, and Sikkim, and that it has not reached to the western parts of India. Captain Sampaio says "that the tree known at Goa as *kusti*, may be identified as *Gynocardia odorata* Roxb., or *Hydnocarpus odoratus* Lind. The tree has all the characteristics of the genus *Hydnocarpus*, such as diœcious or unisexual flowers with five sepals, five petals, stamens five, pistils (styles?) five" and in your editorial you state "you are right in your surmise; the plant of which you sent specimens, is the *Gynocardia odorata or chaulmugra*."* Captain Sampaio is right in saying that the *kusti* of Goa has all the characteristics of the genus *Hydnocarpus*, and hence it is not *Gynocardia odorata* of Roxburgh. I have examined specimens of *kusti* from various parts of Goa, and I believe it is what is called *H. Wightiana* of Blume or *H. inebrians* of Wight well described in Dalzel's Bombay Flora; the *kusti* of Goa is altogether different from *chaulmugra*." The error committed by Captain Sampaio lies, I believe, in confounding the characters of the genus *Gynocardia* with those of *Hydnocarpus* Both these closely allied genera are well described in Bennett's "Plantæ Jav. variores" 207, and in Hooker and Bentham's "Genera Plantarum, I., p. 129.""

The flowers of *chaulmugra* are 1½ in diameter (female larger) of a pale yellow colour and powerfully fragrant. They arise several together, or in fascicles from tuberosities over the trunk and old branches, seldom are axillary and solitary; and Captain Sampaio will

find in the work of Dr. Roxburgh, which he quotes, that the stamens in male flowers are indefinite (about 100), and in the female five short styles with large [illegible] cordate stigmas, and round the ovary ten staminodes.

The flowers of *kusti* are smaller, 1 inch in diameter, dirty white, inodorous and inaxillary, few flowered racimes. The male flowers are pentandrous, *i.e.*, they have *five stamens only*, as Captain Sampaio correctly describes. In the female flowers the stigmas are sessile and lobed, and the ovary is surrounded by five staminodes. For more detailed description see the works quoted above.

Captain Sampaio relies on the character of the leaves of the *kusti* of Goa which he says are entire and not serrated as described by the generality of authors. This certainly puzzles a beginner, but Sir J. D. Hooker in his "Flora of British India," Vol. I., p. 196, says that the leaves of *H. Wightiana* are either *entire* or serrated. I have also found that the leaves of *kusti* are entire, but in some specimens I could distinguish minute serratures.

As to the property of the oil of the seeds, it is believed by the natives of India in general to be useful in skin diseases. I have myself been using it for the last three years in leprosy, leucoderma, psoriasis, &c.

The fruit is said to be used in Ceylon and some parts of India to poison fish. Perhaps Captain Sampaio may think it advisable to experiment and ascertain if the *kusti* of Goa does poison fish.

J. C LISBOA.

Bombay, 17th November 1879.

* We were not personally acquainted with the plant in question, and submitted the specimens to the first botanical authority in Calcutta, on whose opinion our short editorial note was founded; we have every reason therefore for adhering to our opinion. —ED., *I. A.*

OUR FUEL PRESERVES.

(To the Editor, Madras Times.)

THE growing demand for fuel is a question full of interest to all, and the effects of the drain made upon preserves of it must, in a few years, tell with striking effect. Railways and the several steam-employing factories use up a good deal of coal and wood, and the out-look is, indeed, a gloomy one. The coal fields of Central India are too expensive to give much assistance, and the preserves of wood in this Presidency are too costly to be drained. Our north-west jungle, beginning from Kircumbaudy and ending with Cuddapah, dips on either side into a rocky belt, little fit for cultivation, and the jungle thins off to a degree that is very unpromising to all who claim an interest in jungle growth. The introduction of *prosopia* into our plantations promises as good results here as it does in Bengal. It is about the best fuel for engine purposes, and the cultivation of it in this Presidency deserves notice. Though of slow growth, it yet reaches to a size that would be invaluable to steam-engines, and it might, if introduced to this Presidency, take a high place amongst its fuel growths. Men have not yet learned to crowd out the jungles here, as they have done elsewhere, and the cradles of our forest growth require to be carefully watched till they reach to a maturity that would repay attention. Our alluvial districts are not so much utilised as they ought to be, and the growth of jungle about them is not so much encouraged as it deserves to be. Our supplies of fuel might be increased tenfold if an agency were established, outside the forest one, for the purpose of encouraging villagers to bring up a belt of growth. The area of capable grounds is very large, and few people can look to the promising alluvial soils we possess without being struck with amazement at our neglect of them. The estimates of the quantity of fuel that we may grow are rough, but there is little question of its being very much larger if care were bestowed on them. Acacia and tamarisk in the interior, and mangrove in our littoral districts deserve to be better thought of than they are now, and we confess to a feeling of disappointment at not seeing them cared for at Negapatam where the growing needs of the railway, ought long ago to have suggested its introduction. Streeburrycottah is now our principal fuel ground, and contractors agree in stating that the distance wood has to be carried is daily increasing. For railways the demand is always more intense along great cities, where the supply is much diminished for the ordinary wants of the people, and for brick-burning purposes, and what we shall have to do, on a growing scarcity of fuel, ought to be a question, worthy of all attention. Sportsmen, and others well acquainted with jungles, complain of their being cleared to an annoying extent; game is being thinned to a degree that renders law for its better preservation necessary, and until we can learn to see the wisdom of better preservation of it, a Vandalism must extend till, perhaps, it is too late to arrest it. We are burning our candle off at both ends, but yet calmly look on, as if everything were serene in the prospect, and no great day of reckoning were at hand. Goaded on by disheartened conservators, frantic orders are occasionally issued, which drive villagers into the madness of despair, and the prepartion of his scanty food suggests acts of larceny that he would, otherwise, not dream of. A chief want in our agricultural system is that of manure; given it, our soil would return ten-fold what it does now, but with so large a proportion of animal ordure used up for fuel, it is deprived of a nurture which Nature has so bountifully provided, but which man in his selfish ignorance wastes. We need do no more than point to an evil everywhere cried against, of the gradual deterioration of the climate by the immense areas cleared away yearly of their forest growth; the decrease of fodder for cattle is everywhere proclaimed against, but our voice is like that of one crying in the wilderness, when we protest against the denudation. Progressive as may be our action, even now it is still not of a sufficiently active character to produce abiding results. Drs. Cleghorn at Madras, and Stewart in Calcutta have been active with their pens to point out the evils we are rushing upon, but their cries, in season and out of season, have fallen upon unbelieving ears, and waste of our fuel-supply is trifled with, in spite of all protest against it. We may mark off our grounds, carefully take thought against loss by fire, but all our progressive resolutions are of little avail, so long as we fail to convince people of the justice of our claims to protect forest rights. There may be a cry, loud and long, of curtailment of rights at first, but true economy will re-assert its value, and establish the justice of our acts. Act VII. of 1865 gives us power to protect ourselves against a daily increasing evil, and we see no reason why it should not be carried out with greater vigor than it is now.

JUNGLE WALLAH.

COFFEE LEAF DISEASE.

(To the Editors of the Ceylon Observer.)

DEAR SIR,—It requires no apology from me at this time, to beg a corner of your valuable journal for a few remarks on such an important subject as coffee leaf disease. It chances, too, that my name has more than once been mentioned in the *Observer*, perhaps rather more prominently than deserved, as something of an authority on coffee culture. Let it pass. I have been a sufferer like those planters and have, of course, been deeply interested in the disease and coffee culture generally, for many years.

It seems to me that with all the interest naturally pertaining to this matter, there is, judging from the correspondence published in the *Observer*, a great amount of vague and undefined ideas abroad amongst planters regarding the disease and how it is to be cured. Scientific men's opinions are eagerly discussed, and what they have been *said* to say at some previous date, is brought up again and again, as if it would be any good to hold them to their words and observations, which were merely their ideas at the time, and never intended to be received as facts or scientific truths. In all such matters, experiments exactly and carefully carried out are the only means available for arriving at anything like the truth. I fear it may be my misfortune to be set down amongst those who have turned against Mr. Morris, when his back is turned. It is not so; I said nothing against him while he was in the island: there had not been time to test the value of his work. I had a special introduction to him from Dr. Thwaites himself, and spent a portion of three different days with Mr. Morris at the microscope, thought his skill admirable and believed him to be a reliable observer. Still, although all this is true, we have to go further, and the sooner the better. Were Mr. Morris here, he would be sorry to find that somehow he is wrong. I confess to having been led off with him. Of course meetings, lectures, and the like, could not fail to *draw*, on such a deeply interesting subject as coffee leaf disease, the out-come of all this being a great amount of popularity for Mr. Morris, which no one will grudge. Still we were all wrong. The fact is, Mr. Morris, by his too exact and premature definition of the life history of the fungus misled us all, honestly enough no doubt, still it was done. Then, when he left there was a wail from the mass, as if the saviour of the country had been taken away in that individual personage. Did Morris discover anything at all abo . the *Hemileia vastatrix* which Thwaites and Abbay had not published long before? Nothing, I say, but the great length of the filamentous growth, which is unimportant, practically, even if correct.

In regard to sulphur, it is nothing new, others had been trying it before, and the lime mixture was suggested by a Dimbula planter, and is a step in the right direction, from another point of view.

It was quite right to try sulphur, as it is the most convenient substance available for such a purpose as destroying the coffee fungus. We were fortified, too, by the fact that sulphur effectually destroys mildew or blight on the grape, vine, and hop, &c. There is however a great difference between these plants and the coffee tree,—the latter being an evergreen and in a state of activity, more or less, during the whole year, while one of the former, being her baceous, is out of all danger for a long portion of it. The other—the vine is deciduous—and so, any pest is easier dealt with, in case of such plants;—time, being of the greatest consequence, in this, as in most other affairs.

In this country the coffee tree is grown at all elevations, from 1,000ft. to 6,00ft., under much variety of conditions in regard to tempera-

ture, moisture, soil, aspect, &c., and we need not wonder at the outbreak of a disease (we might rather wonder why it has so few diseases and is so hardy!) Under the above noted conditions there will always be a supply of germs or spores of any such organism as the *Hemileia*. They are present everywhere, these spores; as an example let bread get into a certain condition of damp and fermentation, in any climate, and you get the well-known blue mould, a little fungus it is, too. Professor Tyndall's experiments with germs are very instructive, and in time, more will be found out—meantime we know that these are very minute and numerous beyond conception.

Sulphurous acid will kill germs, or anything with life, it corrodes metals, and if you add to it one atom more oxygen, you get the well-known sulphuric acid, the oil of vitriol of commerce.

Caustic lime, too, will destroy most organic tissues, so we never doubted about the shrivelling and death of the *Hemileia* filaments, as seen by the microscope. The cure was found seemingly, and we forgot, foolishly, to consider whether the disease might not come back, *too soon for us*. No danger of that, said Mr. Morris (in effect) "You take it just at the time when you don't see it, and a few applications of the lime mixture will do, and lime alone reduces it 30 per cent."

Now that we have had time to see the effects of these experiments, it is safe to comment on them, and one or two facts I give as briefly as possible, which are the results of the observations of others as well as myself:—

1*st*.—The disease has returned, even before the sulphurous acid had been wholly neutralised.

2*nd*.—It is impossible to use as much sulphur as will thoroughly disinfect the trees without corroding the leaves—in fact where the experiment has been carefully carried out, and proved a failure, the leaves were badly injured and rendered useless.

3*rd*.—Even if success had attended the experiments, the cost of the sulphur, and application three times in one year, would have been prohibitory.

I need hardly inform you, that I refer to the Drayton experiment, where by the kindness of my friend, Mr. Forsyth, I have been able to watch and see the results, having arrived in the island too late in the season to experiment on my own coffee. So much for the sulphur and lime cure—exploded it is—yet I by no means throw up the sponge, in regard to leaf disease, but on the contrary am more hopeful than ever of seeing an end to it—at least so far as to leave ordinary coffee fairly profitable.

The London conference of scientific men on leaf disease is not likely to lead to anything definite or reliable in the shape of a cure. Should it come off—it will in all likelihood lead to the same practical result as the cholera commission did some years ago, and nothing more.

It will be wise to work for ourselves, rather than trust to anything turning up, out of the ordinary course of things—which seldom happens in such cases as this.

In his letter to me, Dr. Macadam states that it will be better to look to the condition of the soil, than trust to anything in shape of external applications; and the best authority on the subject, Dr. Thwaites, of Royal Botanical Gardens here—has I am sure been always of this opinion, and years ago recommended deep tillage and better cultivation, but how slow we are to learn!

From all that has been observed of coffee leaf disease, and judging by analogy, I am of opinion most strongly, that those who hold the view that the *Hemileia is not the disease at all* are very near the truth—and this is partly proved already. The growth and marvellously quick development of the fungus merely shows a certain condition of vitality, or health of the coffee tree, a condition of debility—one may say. This is proved by the fact that well cultivated coffee escapes the pest wonderfully, while neglected coffee suffers most severely.

Our system of cultivation has been barbarous in the extreme—and is so too often still. Improper manures are applied in holes, the former little but slow poisons, the latter being the means of causing the loss of many of the leading roots—which serve as trunk channels for carrying a supply of food for the whole tree. When cut they hardly ever grow again. Who has seen the older estates,—where the pernicious system, and weeding with tools, has been carried on for years, and not marked that each "shuck" old tree stands alone (not in his glory) on a pyramid of subsoil—mining the upper primary roots? Then we are often told that the coffee tree is a "surface feeder." More's the pity that it is often condemned to that mode of living, but the fact is that the rootlets cannot perform their functions but in a soil mechanically free enough to let them have air, and it often renewed—a species of ventilation indeed.

Between hacking the roots,—and very often the branches too, in what is called a good "clearing out," with manures *not based* on the chemical wants of the soil, placed so that but a few of the roots can get at them, no wonder that the coffee tree is, as it is, cankered and ready food for fungi.

The true remedy for most of these ills lies in gradually and systematically loosening the soil by means of tools which will not cut or injure the leading roots; steel forks, spade bars, or the "tramp pick" perform this work remarkably well.

It is cheering to see that the more intelligent workers, are afield with these tools, the use of which, with suitable manures applied early in the season, leave little to be desired by all concerned in the cultivation of the coffee plant, and when such practice becomes the rule, we shall hear less and less of leaf disease.—I am, yours truly,

WM. CAMERON.

Ythanside, Dimbula, 18th October 1879.

ON MANURING COFFEE.

SIR,—I have read with interest the editorial comments on two letters of mine which appeared in your Overland issue of 16th June, just received, and the remarks thereon of Mr. Cochran and Mr. Dixon. The subject is of sufficient importance to justify a further intrusion on your space with a few observations of a non-controversial character.

1—*Ash of Coffee*.—I think Mr. Cochran is mistaken in stating the percentage of ash at 4 per cent. I got some berries calcined in the Laboratory of King's College last year, and the result was 2½ per cent.

2.—*Sources of Potash*.—You have fallen into a very natural error in supposing that I recommended kainit salts. The large percentage of common salt in them renders them very liable to deliquesce, besides forming a heavy percentage of freight. It is practically better and cheaper] to use a less quantity of the best muriate of potash, an invoice of which lies before me giving 88 per cent. of muriate equal to about 47 per cent. pure potash, against 13 or 14 per cent. in kainit, the former costing £7-16s—the latter £2-10s. per ton—freight being the same. Both come from Germany, and there is an intermediate sulphate of potash containing 27 per cent. pure potash to be had for £4-15 per ton, which I intend trying.

3.—*Lime*.—I have observed a disposition in some of your correspondents to treat lime as a manure instead of a fuel or solvent. The old farming proverb is a very true one:—

"Lime and lime without manure
Makes both soil and farmer poor."

And I would suggest another as equally sound:—

"First manure and then lime,
Will surely give good crops in time."

Can you not calcine your stores of oyster-shells at the pearl banks, or coral, or limestone nearer at hand, and spread a few cwts. per acre broadcast every three years? In this way you would best digest into soluble food the potash in your slowly decomposing felspar, as well as the other necessary ingredients in both soils and manures, as the Sussex farmers have done by liberally liming their stiff Wealden clays.

4.—*Phosphates*.—You may not be aware that an abundant source of phosphate lies within easy reach of Ceylon, in what is called the Guano of the Lacipede islands off the coast of Western Australia. It *was* a guano ages ago no doubt; innumerable monsoons have washed out the ammonia, and though it still resembles guano in colour, it is in reality a phosphate, or more correctly, a guano phosphate, I give you the analysis of a sample:—

Moisture	... 24·13
Water of combination and organic matter	... 7·92
Phosphoric acid	... 28·57=Tribasic phosphate of lime 62·37
Lime	... 35·21
Oxide of iron ...	... 3·48
Insoluble matter ...	... 00·69
	100·00

What it cost at the islands I cannot tell you, but it has been sold in London at £4 to £5 per ton, and mixed with ammonia and potash it ought to be an excellent manure for coffee. Here it is used for superphosphate, but after all sulphuric acid only does quickly, what dame, nature does for us slowly and surely in her own way, and I am not sure that the advantage of using superphosphate with coffee, is as great as with annual crops of different kinds, when it may be required for use and not for the two following.

A perfect manure.—Ammonia, phosphoric acid and potash in some form or other and in due proportions, are what we have to combine to form a perfect manure, and the soil analysis is mainly valuable in indicating any partial weakness, which can be strengthened accordingly, Mr. Hughes is, I believe, mistaken (as Mr. Cochran justly points out in his letter of 20th June) in considering any of the soils in Ceylon, the analysis of which you have published, sufficiently rich in potash to dispense with its liberal use in manure, and if the Indian soils I quoted with double the potash of your Dimbula and Haputale soils, require 10 per cent. of potash in a proper manure, according to Dr. Voelcker and

Mr. Dyer] it appears to me folly to give less or more to the latter. Doctors may differ, it is true, but I think that in this case the more experienced practitioners are the safest to follow. As men of business, it is our province to ascertain how we can best work out their prescriptions practically, and I am confident that not only is there no necessity to pay high prices for quack remedies, but that coffee can be much better manured for Rs. 60 per acre, that it is now in many cases for double and treble the money. Good farming does not consist in squandering money, but in getting the utmost benefit at the least cost.

6. *Leaf disease.*—After all that has been written on this subject, I see no reason to believe otherwise than that leaf disease is nothing but Nature's own punishment for our neglect of her laws and our folly in looking for miraculous growth of coffee, when year after year we have been eating up our soil capital, just as the Southeners have eaten up Virginia and others of their most fertile states. Sulphuring is an old and very doubtful remedy for a similar disease in hops, and no doubt about as useful as it is in certain forms of skin disease; it may palliate, but if we want to effect a *cure*, we must stick to constitutional treatment, and nothing else will serve our purpose effectually, as the vine growers of France have found.

Your Planters' Association has done good service in publishing Mr. Hughes' analysis, and I hope no niggardly spirit will induce it to keep back the remainder of his work from your columns, where it will have the advantage of your own excellent comments, and of fair criticism from any one willing to contribute to the common stock of knowledge on a subject in which we are all interested.

The great difficulty to contend within introducing an improved system of manuring, judging from my own experience, lies in the ignorance and prejudice of superintendents who have never before seen artificial manures (I use the familiar term, though it is quite a misnomer) and who look on them, precisely as the old British farmer when guano was *first* introduced, who "couldn't see no good in putting pinches of snuff into wheat fields." Fortunately, however, I am now able to rely on intelligent co-operation, and as soon as Providence blesses us with a fair season, I hope to arrive at more reliable results. I am reminded of a remark of a good old Scotch agriculturist with whom I once discussed this subject, "I'll tell ye *this* from my experience," said he "if ye are going in for artificials, ye must just *ding* some of them into your men's brains first."—Yours faithfully,

H. TOLPUTT.

32, Great St. Helens, London, 31st July 1879.

P. S.—Since writing the foregoing, I am able to furnish you with a strong confirmation of my first remarks on the importance of potash. Here are analysis of three soils from another part of India:

	No. 1.	No. 2.	No. 3.
Lime ...	·410	·393	·263
Potash ...	·283	·244	·418
Phosphoric acid ...	·045	·050	·032

and you will observe the percentage of potash is higher than in any you have published, particularly No. 3, which is the highest I have seen anywhere. They are from estates which have been starved and mismanaged, and of the third an old superintendent remarks, on hearing that it had borne a moderate crop last season, "You see all their bullying hasn't killed it!" The report accompanying the analysis points out the low percentage of phosphoric acid as the prominent feature which calls for attention, and a liberal supply of phosphatic manures. Liming is recommended, if not too expensive, both as increasing the quantity in the soil, and rendering the potash more available as plant food, than it probably is in the condition in which it already exists in the land. The para. on this subject concludes as follows:—"I should not at the same time advise you to dispense by any means with artificial potash, merely because the percentage of potash is equal to a little above the average." This is sound advice which I intend to follow.—H. T.—*Ceylon Observer.*

KOTEGURH NOTES.

SIR,—The weather has been satisfactory and very suitable for hay-making and gathering in the autumn harvest (vern. *kharif*). Some of the zemindars say they would have liked a little rain, during the past week, to soften the ground for their ploughing operations for late sowings of barley and wheat, but I fancy they refer more to those of their fields which are situated at a distance from their cattle styes, and which, therefore do not receive much manure, than to their "home" fields—which are well manured—and which appear to be all that can be desired. There was one day (23rd) on which hail fell, but it was not much, and did no harm to the amaranth, (vern. *batu tulsi*) the chief crop now ripening. Snow whitened the higher range down to 14,000ft. The atmosphere is beautifully clear and the power of vision seems almost doubled, and sounds can be heard at long distances. The climate is of that delightful kind known in Canada as the "Indian summer." We have taken to fires of an evening since the 15th, and shall commence them in the mornings from to-morrow, 1st proximo.

The hill sides now present a charming appearance, covered as they are, with various hues of the crops just ready for the sickle; there are the brown of the kodra, pink of the raphrah, white of the ogal, scarlet, yellow, and white of the batu, interspersed among which are the newly ploughed fields, fields of young barley and crops of an emerald green, patches of arborescent vegetation and brown sides of the hills, hay, villages, roads, footpaths, green slopes of the terraces of the fields, precipices, and a magnificent background of forests of pines and deciduous trees, the latter of different colours including scarlet, yellow, and brown, while away in the distance are the white peaks of the snowy range of the Himalayas.

The following is a comparative table of the past five seasons:—

	1875.	1876.	1877.	1878.	1879.
Rainy days..	....	1	....	1	1
Wet days ..	4	5	7	..	2
	Good for hay-making, ploughing, and gathering in the autumn crops.	Same as previous year.	Same as previous year.	Good for hay-making, and gathering in the autumn crops; since the 15th; ground very hard for ploughing.	Same as previous year.

Wind chiefly N., occasionally N. E., which brought up the hail: slight thunder and lightning; atmosphere very clear. Hoar frost on the 24th. During the first week heavy dews at night.

The thermometer (Fahrenheit) hung in an open verandah (6,400 feet above sea level). W. aspect is about 54° in the morning, 68° in the afternoon, lowest 48°, highest 68°.

The following vegetation is ripe:—Cones of the cedar (vern. *kelu*); hemp (vern. *bhang*), the villagers make rope from the fibre; fruit of the wild pear (vern. *shegul*), its taste is bitter and is tasteless until half rotten, when it is eaten like a medlar; the marvel of Peru (vern. *gulal*), from the kernels of the seeds a "white" writing ink is manufactured, to write on slate and board with, after the manner in which some banias keep their tallies; the flower is of a handsome red colour, occasionally yellow ones are met with, and it blossoms during the early part of the month, the Oreoseris lanuginosa (vern. *kupra*), from the tomentum on the under side of the leaf, a very useful tinder is made, the villagers generally carry a small quantity with them, and with it and the assistance of a flint and steel, are always in a position to obtain a light for smoking or cooking purposes. The colocynth (*rakś-ka-kimtu*, *i.e.*, the lime of the evil spirit) used as a purgative by some, and dreaded as a poison by others; the bryonia umbellata (*mohkri*) the fruit has a sickly sweet taste; the horse-chestnut (*kanor*) the seeds are pounded up and used for washing clothes; they also make a very good starch, an experiment in connection with which is now in progress, particulars shall be sent to you in due course.

The poplar (vern. *chelum*) is shedding its leaves, colour faded yellow and light brown; the hill-cherry (*krün, jamun*) deeper yellow and brown; the rhus (*tittar*) of a handsome scarlet; maple, of a bright yellow, the Himalayan vine, resembling the Virginia creeper, is now in all the glory of its scarlet uniform, some are of a brown colour; the leaves of the peach are brown; ferns present a beautiful appearance, and are of many shades, green, brown, and golden; there are 35 varieties of ferns that we are personally acquainted with, and I daresay there are many others which we have not yet noticed. The wild rose bushes are covered with scarlet berries; while the Himalayan honeysuckle (*bajheol*) has its white berries, resembling white currants. The Prinsepia utilis (*bhekal*) is coming into flower, white with coloured pistils; the wild cherry (*padam*) is in blossom, pink. The grasses are turning brown, the spear-grass being in unpleasant profusion. The Himalayan ivy is coming into blossom.

The monauls now become less shy, and will continue so until spring; they prefer horse-chestnut forests. Chakore shooting is now extremely easy. Woodcock migrating to the plains. Quail in small numbers, and found chiefly in the fields containing the eleusine corocana (vern. *koda*). Starlings and teal are met with; the owl still hoots. The villagers have a legend in connection with this bird to the following effect:—On one occasion the birds were going to a *mela* (fair), and the owl becoming envious of the gay plumage of his neighbours, asked each one to lend him a feather with which to deck himself out and be smart. They did so on condition that he should return the feathers at the conclusion of the *mela*; the owl became so vain of his appearance in his borrowed plumes, that he refused to give them up, whereupon the birds called a council, with the result that they no only regained their own feathers, but stripped the owl of all his own;

the consequence is that he cannot show himself in the daylight, but can only come out at night in the dark.

Monkeys have returned, and commit havoc with the standing crops of amaranth (*batu*); the villagers have to remain out the whole day to drive them away, and this leads to a good deal of personal abuse between neighbours, who, to save their own crops, are obliged to drive these destructive animals into other fields adjoining their own, which being objected to by the proprietors, a wordy warfare ensues, ending in two or three zemindars banding themselves together and driving the monkeys into the crops of some one who is not on guard, or has left his post for some reason. Bears come out at night time and destroy the buckwheat (*gaphrah*, *ogal*) crops; so that for a short time, annually, the villagers have their time fully occupied in guarding their crops.

Rats are very numerous this year. The villagers ascribe this to the fact of the mildness of last winter, which did not kill them off in the ordinary manner. The consequence is that they have increased and multiplied in unpleasant numbers. We still hear the fox at night time.

Bees are in abundance, and hard at work among the flowers belonging to the N. O. Labiatæ.

A fair neighbour of mine has just drawn my attention to an omission in my notes in your issue for the 1st of November in connection with "cocoons of the wild silkworm." I ought to have added:—They have nothing whatever to do with the cocoons from which silk is ordinarily made; but are the nests of the female Mantis (the *mantidæ* division of the family of orthopterous insects) who deposits her eggs upon plants and covers them by a glutinous substance, which soon becomes hard and forms a kind of case in which the eggs are arranged in a symmetrical manner; these cases or nests differ in form according to the species.

The villagers are now busy with the autumn harvest (*kharif*), consisting of phaseolus radiatus (*urad*, *mah*), dolichos uniflorus (*kult*); both these are similar in appearance. The former has large leaves and ripens first, the latter has small leaves and ripens later:—Eleusine coroсana (*kodra*, *koda*) resembling a child's hand, stalks used for cattle fodder:—table rice (*basmati dhan*) and common rice (*reri dhan*, and many other names). The villages are again partly deserted (as at the sowing and transplanting periods), while the population go down to the valley to gather in the rice crop and stack it for the present, as it is considered unadvisable to thrash out newly cut rice. The stacks are very neatly built up circular, and greatly resemble an English hay-rick at a short distance; while on the subject of rice, I may as well mention, that an owner of rice-land, is not spoken of as possessing such and such an area of *kyar* (rice-land), but is said to have so many "*kalrahs*" (bags made of goat or sheep skins) full of *dhan* (rice), one *kalrah* being reckoned to contain 2 bhars (=50lb. common, or 42lb. table rice); in this manner a man's standing among his neighbours may be known. Amaranth, or Love-lies bleeding (*batu tulsi*), there are several varieties, some having handsome thick hanging bunches of different colours, white, pink, and blood red; the leaves are used as a pot herb, but act astrigently:—The two kinds of buckwheat (*ogal* and *paphrah*), these are very similar in appearance, the former having pink flowers, ripens first, is grown at low elevations, is reckoned the better grain, is given complimentarily to superiors, and may be eaten on "fasting" days; the latter has white flowers, ripens later, is cultivated at higher elevations, and is heating and bitter:—Tobacco (*tamaku*), the flowers are cut off soon after opening to give extra strength to the leaves; the leaves when cut are spread on the roofs of the houses to dry:—pumpkins (*kadu*) also placed on the roofs to dry:—Grass is still being cut, the forks and lower branches of trees are frequently made use of for stacking grass in.

Honey is now being offered for sale; price rather high, 4 seers per rupee, owing to the demand being at present, greater than the supply.

Sheep shearing is going on; the villagers shear their sheep *twice* a year, once in May when the barley is harvested, and again in October when the batu is ripe. The yield is about 12 ounces of wool from each sheep. Before selling a sheep, the villagers always cut off its wool, no matter what the quantity may be. Young wheat and barley sprouting and looking strong and healthy.

Chrysanthemums in blossom.

Jerusalem artichokes ripe. The weight of that large pumpkin to which I have before referred, is 64 seers (=128 lb.=9 stones, 2lb. There were several others, but they weighed a little less. Tomatoes were over about the middle of the month, after which they become nearly tasteless. Chinese and American maize (sown by way of experiment, ripe, produce satisfactory.

G. P. P.

31st October 1879.

The Indian Agriculturist.

CALCUTTA, DECEMBER 1st, 1879.

COFFEE LEAF DISEASE.

WE have been favoured with a lengthy letter from a correspondent who seems to us to understand this disease more fully, than the doctors who have lately been diagnosing it, and attempting its cure, but we are sorry we cannot insert his letter, as it contains too many personalities to be suitable for our columns. This, however, does not blind us to the extensive knowledge which he seems to possess of the subject under discussion. In many points we agree with him fully, and in the few remarks we propose to offer here, we will occasionally consult his letter.

The subject of coffee cultivation has perhaps not occupied quite so much of our space, as the importance of the industry seemed to demand. This has not been caused by any lukewarmness on our part, but was principally brought about by the distance at which we are, from the coffee plantations and the scarcity of exact information on the subject. We have had the opinions of various sections of planters displayed before us in the Ceylon papers, but from these we are unable to draw definite conclusions, owing to the tincture of personality which pervaded the majority of these communications. A writer did not seem to be able to discuss the subject without insinuating something base or unworthy, against those who happened to hold different views from himself. This to a large extent detracted from the value of the arguments adduced, because abuse or even bare assertion can never have any value in an argument.

We have been looking closely into this important question, and at the outset had some qualms of conscience in placing the title we have adopted, at the head of this article, as we have come to the conclusion that the phrase *Leaf Disease* is a misnomer. Undoubtedly the results of the disease are palpably shown on the leaves, but that does not constitute it a leaf disease. When any of us is troubled with a bilious headache, we certainly feel the pain in the head, but we never think of calling it a head disease, as we at once take steps to apply a remedy to the cause of the disease, and take medicine to put our stomachs to right, such is our opinion of this so-called leaf disease. The manifestations are in the leaf, but where is the source of the disorder. The potato disease, so well known at home, is clearly not a leaf disease, but still the first and most evident signs are in the green haulm and the leaves, and we strongly suspect we shall have to look lower down for the origin. Some few hold the opinion that it is primarily a root disease, and that to apply sulphur, lime, or in fact *any* medicine to the leaf, would be like applying eau-de-cologne to the bilious head-ache referred to, it might for the moment afford a temporary relief, but it would have no effect whatever in attacking the seat of the disorder, and in giving the sufferer any permanent alleviation of his pain.

In looking into the sources of this disorder, we must go back to first principles. The grand object which Nature has in view in the growth of plants is clearly the propagation of species. The first great order we have on this subject is, "Let the earth bring forth grass, the herb yielding seed, "and the fruit tree yielding fruit after his kind, whose "seed is in itself, upon the earth; and it was so." Such being the case, we naturally expect that plant life will be specially adapted to carry out this great behest. And so it is. But for purposes of our own, we interfere with the

natural order of things, we do not permit these plants to grow in a state of Nature, we want more seed and fruit than the bushes would produce in the ordinary course of Nature, and hence we adopt means to that end. We interfere with the growth, we prune heavily and thus throw a vast deal of recuperative work on the roots, at a season when in the usual course of Nature they should be resting. When the root should be recovering itself after the past season of hard work, as it were, we interfere with that period of rest, and compel it to resume work, and not its natural work, but extra abnormal duty, such as in the ordinary course of things the root would never be called upon to perform. It has to set about the supplying of fresh lung-power, and hence to some extent, we must expect an exhausted root, and with a root used up as to energy, we need scarcely look for a particularly healthy plant. Now and again plants have an off-season, when as it were, their energies lie fallow, but the coffee planter looks on a fallow season, as subversive of all commercial prosperity, and cannot permit them, pruning and artificial manuring are resorted to, and year after year, decade after decade, these unfortunate plants must go through the same eternal grind, and is it strange if Nature rebels at all this. We know the inexorable laws of Nature to be, that a breach of them, invariably brings a punishment in its wake. The penalty may be deferred, on account of the lightness of the breach, or the natural power of the object thus wrongly treated, but it is inevitable.

All this, if true of coffee, is in a greater degree true of tea—where the pruning and plucking process is carried on weekly during the entire period of the plant's growth, but we are not now speaking of tea, we only offer the various blights which affect that plant as lending additional force to our remarks. We do not advance this dogmatically as *the* reason for or cause of this leaf disease, we offer it as a contribution to the discussion, and as, in our opinion, a reasonable one and well worthy the attention of planters. We think too that this conclusion is strengthened by the recent failure of the sulphur—lime cure—for we may call it a failure—if, as we suspect the disease is radical, and not of the leaves, then this sulphur—lime cure could not prove otherwise than a failure.

SOME DIFFICULTIES IN INDIAN AGRICULTURE.

IN any attempt to effect improvements in Indian agriculture—or indeed in any matter calling for improvement—one of the conditions necessary for success is a knowledge more or less complete of the difficulties to be encountered and overcome.

We believe, and those who know anything about the subject will agree with us,—that it would be difficult to find on the face of the earth in ancient times, or in modern, a creature so helplessly poor, as the Indian ryot. The homestead of the ryot consists of four or more rude huts built of bamboo and matting, or bamboo wattled and mud plastered, or of mud above and thatched with jungle grass. There is no furniture, the greater number sleep on mats on the mud floors, a few may have *charpoys*, that is, rude four-legged frames about the height of a chair covered with interlaced cord or sacking. The fire-place is a mud one, made and cared for by the women, who keep the floors clean, cook the food, husk the rice, spread the seed to dry in the space inclosed by the huts, look after the babies who tumble about without a thread of clothing in the same enclosure, draw water, and tear each others character to tatters round the village well or tank. The cooking utensils are earthen-ware or brazen, and have not changed in shape since pre-historic times. There are two meals each day consisting of rice, some kind of pulse (dhall) and chillies or some other equally cheap vegetable, with occasionally fish when it can be bought. Food is eaten with the fingers frequently from plantain or other leaves to avoid the necessity of plates. The dress consists of a *dhoti*, a loin cloth, and a turban, the house rent may be Re. 1 or Re. 1-8, the cost of the homestead if not built by the ryot himself may be about Rs. 30 for the largest mat hut. His pair of bullocks may cost Rs. 30, more or less. The bill-hook can be had from the village blacksmith for four annas. The plough the ryot may construct himself, with the loan of a few tools from the carpenter, and a rupee to the smith to have it shod with iron completes it. The plough is shaped like an anchor, with the flukes at different angles, the one pointed with iron may have an angle of say about 45°, this arm scratches the soil, the other arm stands nearly at right angles to the shaft, on each side of which the bullocks are placed, like the pole of a carriage. The upper arm is held to guide the plough. The bullocks put their necks under the cross-shaped end of the shaft, and the humps on their backs serve for collars, a rope passed through the centre sinew of the nose serves for reins, and the tail is twisted by way of admonition. Bengal ryots—unless a fortunate few—too insignificant to be considered when speaking of ryots as a class, are utterly without savings. Unaided, they are frequently unable to renew even a worn out plough, much less purchase a new yoke of bullocks, often the seed for next sowing has to be borrowed at ruinous interest. The rice for food, and seed to keep his family going till the harvest comes, is borrowed from the money-lender (*mahajan*) at fifty per cent. interest. The usual rate for money is two per cent. a *month*, either in *kind*, or coin at the current bazaar rates. The land cultivated by a family or homestead may amount to from two to ten or more acres, consisting frequently of plots at some distance from each other, and which may or may not have been in the occupancy of the family for generations; and for which he pays an equivalent either in kind or money to one or more middlemen or tenure-holders, who again, because of the intricate and perplexing sub-division and joint interest in the soil, pass it on more or less diminished till, it reaches the *zemindar* who finally pays a yearly tribute to the Government. The heaviest item in the ryots' expenditure is for food, and although probably Rs. 7 or 8 a month will keep a whole family, even for this he has a constant struggle, often ending in inextricable indebtedness. Were it not for the luxuriant climate and the possibility of sustaining life and a certain type of health on the scantiest means; an existence such as this would be utterly impossible. We venture to think that the social condition of the Indian peasantry is without a parallel in the history of the world. The land tenure of India, one of the most complicated and perplexing that ever existed, has in its growth of centuries, aided by the rapacity of various rulers, slowly closed round the ryot, till he is in reality a mere starveling covered with a rag, the play thing of ignorance and superstition, the wretchedest creature on God's earth, with nothing to live for, nothing to hope for, but in the present rice and *dhall*, and in the future, annihilation. No doubt there are exceptions; beyond question there are ryots who accumulate savings; communities that possess advantages that their poorer neighbours do not enjoy, comforts and necessaries that others scarcely realize. Middlemen are not all oppressors, money-lenders not without bounds of compassion, and zemindars with loftier ideas of existense and duty than those of extracting the last lees which might, and the law allows them; but in the main, poverty of the most abject kind, ignorance of the grossest description, apathy, hopelessness, and an appalling indifference to life not to be matched out of the East, which enables them in times of famine to lie down by the roadside and die, with scarcely a murmur, are notable characteristics of the Indian peasantry.

On a former occasion we said in substance, that for India's agricultural ills there was no one panacea, any more than there is a royal road to knowledge. A people can not be made prosperous and contented by laws alone, though these may help much. Prosperity cannot be conjured up by budgets and statistics, though these have their uses. There are more things in human nature than are dreamed of by some projectors and advocates of irrigation, and works of national usefulness begun in haste in times of famine-panic, to be abandoned to leisurely decay. High class farming and soluble phosphates and Kew gardeners are mere mockery to men engaged in a life-long struggle with starvation, however useful and appropriate they may be to men of substance and with savings. It seems to us that some of the things the ryot wants are to be taught both by precept and example, habits of forethought and thrift. As long as he sees his wealthier neighbours living in a style and with surroundings little better than his own; and spending much of

their savings in poojahs and funeral feasts and marriage festivities, the tendency will be, that he should seek to follow the example continually before him, and live from hand to mouth, never out of the money-lenders hands as all his father's were. This thrift and forethought we believe may only be hoped for, when all who are in authority, or have any influence over the higher class peasantry, use that influence and authority on the side we have indicated. The up-keep of village schools by the more wealthy natives and the judicious selection of books and teachers should unceasingly be brought under the notice of all who may in any way be induced to help in a matter of this sort. It is by the spread of knowledge of all kinds among the lowest peasantry, not necessary book-knowledge at first hand; but knowledge received in conversation with it may be their own children, their wealthier neighbours, or knowledge derived from the Government official either at second or third hand, or the knowledge that may be gained from the results of a "Model Farm" conducted on the principles of common sense, and exhibited in tangible form in the village bazaars, and elsewhere, in a hundred shapes. In these ways it may be hoped that the lot of the Indian peasantry may in the course of time, with the spread of intelligence and the growth of thrift, be somewhat less wretched than in too many cases it is at present. In the meantime every scheme that may in any way tend to diffuse knowledge, and break through the crust of ignorance, superstition, poverty, and the evils of middlemen, money-lenders, and tenure-holders innumerable, deserves support from all who have the welfare of India at heart; so that, however, Viceroys may come and go, departments wax and wane, and lesser lights in the official firmament flit from place to place, and rise and set, a people, thrifty intelligent, and prosperous, may grow up to develope the vast resources of India, and to carry on to succeeding generations some of the best features of the English rule.

LIME AND ITS USES IN AGRICULTURE.

LIME has been in use for agricultural purposes for a very long period. As early as the reign of the III. Edward, 1327-77, it was in common use in the south of England, and for hundreds of years before that time farmers whose land adjoined the sea, where the rocks were calcareous, or where the beach was chiefly composed of the shells of cretaceous animals, ground to fragments by the action of the waves, were in the habit of adding these to the land. A calcarious earth is found at the bottom of bogs, and is formed in many lakes in all parts of the world, composed chiefly of the shells of the cretaceous animals, mingled with fine mud deposited in the still waters of the lake, clay in fact. Where the waters of the lake have been less still, or the currents sufficiently strong to hold in suspension and carry further on the fine mud, the shells are found mingled with an amount of decayed vegetable matter, which when the bog was forming gradually encroached on the waters of the lake, and ultimately occupied its place. These marls as they have been called, have been used on land, by cultivators with varying effects. The discovery of their usefulness was as a rule, accidental, and their effects on the crops raised on the land cultivated was perfectly unknown beyond the immediate present crop, which seemed to profit by their application. Farmers followed "the tradition of the Elders" and let results and consequence look after themselves. The value of these marls varies with their composition. The proportion of carbonate of lime may be as small as 8 per cent., or as high as 80 per cent., they may or may not contain phosphate of lime or potash; and it is only by watching their effect on soil, or obtaining a knowledge of their composition by analyses that their value can be determined.

Lime is the only oxide at present known of the metal *calcium*. This metal is seldom prepared in the laboratory, it is of a pale yellowish white colour, tarnishes readily in the air, and when placed in contact with water, the latter is decomposed, hydrogen being set free, and the oxygen unites with the *calcium* to form lime (Ca O) Lime is extremely abundant in Nature as carbonate and sulphate. The chalk and limestone rocks consist chiefly of carbonate, more or less pure, and they are the most widely distributed by all the stratified rocks. The soils produced by the disintigration of these rocks will be of greater or less degrees of fertility according to the character of the limestone. Generally they are light and porous; and when chalk and clay have combined to form a soil, it usually possesses the highest degree of fertility.

Composition of some limestones.

	Carbonate of Lime.	Carbonate of Magnesia.	Phosphate of Lime.	Oxides of Iron and Alumina.	Silica.	Sulphate of Lime.	
Antrim ..	98·63	0·83	0·10	0·08	0·45	....	*Hodges.*
Dublin ..	85·00	....	....	9·5	18·00	....	*Griffith.*
Mid Lothian ..	93·61	1·62	·56	·45	20·00	0·93	*Anderson.*
Dumfries	53·81	80·41	....	2·00	2·31	0·10	*Anderson.*

It will be seen from the foregoing table that the composition of limestone varies considerably, that it contains small quantities of other substances which find their way into the soil, and in some cases add to the bulk of plant-food. An average of the above analysis gives about 77 per cent. of carbonate of lime. There are, however, limestones which have large quantities of their carbonate replaced by magnesia, and because of the high percentage of this substance are called dollometts or magnesian limestones, the last in the table, that of Dumfries, is an example. Magnesian limestones are as a rule injurious to vegetation, and soils produced by their disintigration are frequently barren or inferior.

Lime for agricultural and other purposes is prepared from the common limestone, which we have seen is more or less impure carbonate of lime.

The limestone is placed in a conical *kiln* in which a fire is kindled at the bottom, and kept burning for some days, during which the limestone is raised to a red heat, the carbon dioxide (Co_2.) is driven off and lime calcic oxide (CaO.) remains, this is the "burnt lime or quick-lime" of commerce. When water is thrown on this quick-lime, it rapidly absorbs, it falls to pieces and gives off heat sufficient in some cases to char wood, explode gun powder, and set fire to barges containing it. It has been estimated that one ton of quick-lime takes up about five hundred weight of water. Quick-lime left exposed to the air gradually attracts moisture and crumbles to powder. In this condition it is called *slaked lime*, or *mild* lime, in contra-distinction to *caustic* lime, before slaking. The water unites with caustic lime (CaO) and forms hydrate of lime (Ca O H_2 O). When left exposed to air for a sufficiently long period, caustic lime or quick-lime gradually attracts moisture, and carbon dioxide, it falls to powder, and in time returns to its original form of carbonate of lime, only in a very finely divided state.

In all soils produced by the disintigration of such rocks as granite, gnesis, and porphyry, the action of quick-lime has the most beneficial effect. These rocks contain large quantities of the *double silicates* of alumina and potash, which are slowly acted on by atmospheric and other agencies. The effect of quick-lime on soils of this character is to render the *double silicates* speedily soluble. This point, and the action of lime on clay lands have been already noticed under mineral plant-foods, *silica*. Many soils contain *iron pyrites*, especially those derived from organic sources, slates and other rocks contain this *disulphide* of iron (F S_2) iron pyrites. It is met with in the form of crystallised yellowish cubes. Atmospheric influences change this by the addition of oxygen to sulphate of iron, which is soluble in water, and may then be available as plant food. Lime materially aids in effecting this change. The oxides and other compounds of iron in the soil have probably not yet received that attention which their importance would seem to indicate they deserve. A *peroxide* of iron, that is an oxide which contains the highest possible amount of oxygen is, as a rule a valuable constituent of a soil, because it is slowly giving off its oxygen at depths in the soil to which the air does not usually find a ready entrance. This goes on till the *peroxide* is changed by loss of oxygen, to the *protoxide*, an oxide with the lowest possible amount of oxygen, this latter oxide along with the *sulphuret* of iron have an injurious effect on vegetation. If either of these exist in the subsoil, and deep or subsoil ploughing be resorted to, the effect on the land for some time will be most disasterous, until such time as the natural agencies ever effecting the soil have changed the *sulphuret* to the *sulphate* and the *protoxide* to the *peroxide*

by the absorbtion of oxygen. In the latter changes no doubt lime exercises a beneficial influence.

Lime is applied to the land in three states—

(1). In a caustic state directly from the *kiln*, slaked by water.

(2). In a partially mild state, by the absorbing of water and carbon-dioxide from the air.

(3). In a mild state made into a compost, with refuse or applied in the form of sand, comprised chiefly of shell-fragments and marl.

The rules for its application may be stated as follows:—

(1.) In reclaiming peaty soils, or stiff clays or land containing substances detrimental to the growth of the finer grasses, such as free organic acids, low oxides of iron, or sulphurets of iron, it should be applied as hot as possible. The quick-lime should be carted off from the mouth of the *kiln* as soon as it is cool enough to be placed in carts, laid down in the field, slaked at once and *harrowed* in. To lay quick-lime down on land, and let it lie there till it has been slaked by the rains and dews, is to allow it to lose much of its power of effecting those changes for which it has been so justly celebrated. Long exposure to air, we have said changes the quick-lime ($Ca\ O$) first into hydrate of lime ($Ca\ O\ H_2\ O$) then into carbonate of lime ($Ca\ O\ C\ O_2$); in this latter state, it is chemically the identical substance it was before being burned in the kiln, *viz.*, limestone; the only difference being that it is now in a finely divided state; it is no longer quick-lime, it has not the power to set up those changes for which it has been so long famous. It is neither necessary nor desirable, rather the opposite, that preventable loss of this kind should go on under the very eyes of the cultivator himself. Whatever method may be adopted to slake the lime, it should be one entailing the least possible delay; so that the newly formed hydrate of lime should be brought as soon as possible in contact with the particles of the soil; for, much of its virtue on land of the character we are at present considering, consists in this, that it takes up the abundant carbon-dioxide given off from the peaty soil, in this way hastening its disintegration, as well as the organic acids formed in the process of organic decay in soils rich in vegetable matter; and which are injurious to the growth of other than the coarsest and least palatable grasses. Lime exercises an important influence in the liberating of potash and soda from the inorganic particles of the soil, in a form available for plant food; and its action on the formation of the double silicates,——a most important point—has been already noted.

2nd.—Lime should not be applied to land at the same time with any manure containing nitrogen, ammonia, (H_3N). If the manure containing the nitrogen is first ploughed in, then the lime scattered over the soil, and harrowed in, the ammonia, which might otherwise be dissipated, and lost to the crop, will either be absorbed by the particles of the soil, and given up as plant food, or it will unite with the potash, and form nitrate of potash, a most valuable fertilizer. It is true that manures containing ammonia, such as farm-yard manure, when brought into contact with caustic lime, will give off ammonia, and if no means are adopted to secure this most valuable of all plant-foods, it may be lost to the farmer, a compost formed of farm-yard manures or organic refuse of any soil and earth to which lime is afterwards added, secures the possibility of any chance of waste, and when the ammonical manure is first incorporated with the soil, and then lime added, the same conditions are realized which bring about, in a somewhat rougher form, the production of nitrate of potash in what are called Nitre beds.

3rd.—If the soil is a poor one, and deficient in vegetable matter, or light and porous, lime applied in the form of a compost, and in small quantities, or in the form of shell sand may be useful. In soils charged with decaying vegetable matter, and in heavy clays, the more energetic the action of the lime, the better the results are likely to be.

4th.—The tendency which lime has to sink in the soil is taken advantage of to bring it to the surface by deep ploughing, thus rendering a new application unnecessary. This fact of the gradual sinking of the lime in the soil should of itself, apart from the other reasons given, be sufficient to ensure that it should never be buried too deep, but, as we have said, harrowed in.

Landc recently deep ploughed, or not perfectly drained, provided other things call for its application, will require a larger dose than that sufficient for light soils. It may not be unnecessary to notice, that while the action of lime on moors and moss lands, peaty soils charged with a superabundance of decaying vegetable matter, where the herbage is of the coarsest and most innutritious kind, is of the most marked description, producing in a few years the finer and more succulent and palatable grasses; nevertheless what is propularly called *sourness* in land, may be due not to the want of lime but to the want of proper draining. Plants of the genus Carex, Rumex, Juncus, and others, delight in a superabundance of moisture, and are sure to thrive on pasture lands, indifferently drained, or low lying. Efficient drainage removes the conditions of existence essential to plants of this character, and these being absent, they naturally die out and give place to herbage better suited for and preferred by cattle.

The action of lime is thus of the utmost importance. There is no cultivated plant that does not require it as food, root crops and leguminous plants using it in most abundance. Its chemical action on the constituents of the soil, and the almost miraculous effects it produces on indigenous plants in pasture and clay lands properly drained, have been noticed briefly. Its mechanical action in effecting changes on the texture and mellowness of soils is also of considerable importance. All these things considered, there are few products, natural or artificial which practise or science has commended for use in agriculture, which, taken singly, can do so much for the soil and the developement of its productive powers than lime when judiciously applied.

Its uses may be shortly re-stated as follows:—

1st.—It supplies a necessary plant food for all cultivated plants.

2nd.—In all soils which contain a large proportion of vegetable matter, it hastens decomposition, and thus corrects the excess.

3rd.—In soils containing the organic acids, and where drainage has already been effected, it produces a marked change in the character of the indigenous vegetation.

4th.—It sets up the action of the formation of the double Silicates and the liberation of soda and potash.

5th.—It assists materially in the production of nitrate of potash in the soil.

6th.—It promotes a physical change in the soil which renders it freer, and more productive.

7th.—In conjunction with salt it increases the quality and weight of the straw on moss lands. It has the reputation of shortening the time of growth, hence quickening the ripening of grain and roots; it is belived to be a cure for "finger and toes" in turnips; it makes the pea more easily boiled, and the potato less watery, but we have been told by an experienced planter, one whose opinion is well worth having, that water charged with lime, is most disastrous to the tea plant.

It would be difficult to find any one substance in use in agriculture for which so much could be said.

MR. CAIRD ON INDIAN AGRICULTURE.

MR. CAIRD'S articles on India, which have appeared in the *Nineteenth Century*, are deserving of attentive consideration. Three-fourths of the people in this country entirely depend on land for subsistence, and agriculture is in a deplorably backward condition. As Mr. Caird is an acknowledged authority in matters agricultural, it cannot but be interesting to know what he thinks of the systems of cultivation pursued here. His inquiry as a member of the Famine Commission commenced at Cawnpore; and he made a rapid tour through the North-Western Provinces, the Punjab, Oudh, Bengal, Madras, and Bombay. Mr. Caird thinks, the agriculture of the neighbourhood of Cawnpore good; but he states that the produce of wheat in that part of the country is about 16 bushels an acre, little more than half of an English crop. The outturn, he says, might be doubled by an application of the nitrate of soda; but he admits that owing to the respective values here, of wheat and nitrate of soda there would be little profit. The Famine Commissioner inspected the Cawnpore Experimental Farm under Mr. Buck, and saw trials of native and foreign ploughs, sugarcane mills, water-lifts, fanners for cleaning cotton, examples of deep and shallow ploughing, forage plants under irrigation, varieties of fruit trees for distribution, the application of manures—the advantage of which to the neighbourhood cannot be doubted. We have always recognised that by deeper cultivation of the soil and free use of suitable manures much

good can be done. But the question is—Where are the cattle to be found for deeper ploughing, and where will manures come from? At and about Cawnpore, Mr. Caird found the cattle to be "poor, half-starved little animals, fed on anything they can pick up in the bare fields, on the cut stocks of the bajri, which is neatly chopped or cut, so that not a particle is wasted." Before there can be a deeper cultivation of the soil, the breed of cattle as well as the plough must be improved. Mr. Caird says that it is the universal practice in all parts of India to make the dung of the cattle into sun-dried cakes for fuel. So long as the manurial substances at the command of the ryot must be burnt for cooking his food, the land cannot be freely manured. The substitution of cheap wood-fuel for cow-dung in order to preserve the manure for the land, is therefore of great importance. The Forest Department should be required to devote its attention to this subject. Mr. Robertson, the able Superintendent of the Sydapet Experimental Farm, told Mr. Caird that cheap wood-fuel might be supplied by planting hedge-row timber, the *Juga dulcis*, of quick growth, which in three years would yield four tons of wood fuel per mile. An experiment has been made at Sydapet to ascertain the value of cow-dung as manure in its natural state, as compared with the ashes of the same quantity after being burnt and used as fuel. To two equal adjoining plots of land these were severally applied. The plots were otherwise treated alike, and they were sown with cholum. Plot No. 1 yielded 5,738lb., while the outturn of plot No. 2 came up to 5,544lb., the yield of the two plots being "so nearly alike as to lead to the inference that the universal practice in India, of using the dung first for fuel and afterwards as ashes for manure, ought not to be hastily condemned." Then, Mr. Caird shows that the Indian cultivator is not so very disinclined to give up his old ways and adopt new crops, as is generally supposed. Mr. Drummond of Shahabad, who has been fifty years in India, and has thus a right to speak with the weight of great experience, assured Mr. Caird that the ryot is "quite ready to adopt new crops when proved to be remunerative." As a remarkable instance of this, Mr. Drummond mentioned the rapid increase of the sugarcane crop, the produce from which has been increased tenfold in the Shahabad district in three years. Again, Mr. Caird speaks very highly of the intelligence and business-like habits of the Indian cultivator. In walking through the fields in a village about Lahore, the Famine Commissioner was struck with the ingenuity of the sower, and he remarks that "the most perfect English drill could have done the work no better." In walking over the land of another cultivator in the neighbourhood of Delhi, he found the man so intelligent, industrious, and careful, that he thinks that "no Englishman or Scotchman of the same rank could be more clever and business-like in his explanations." The testimony of an unbiassed observer like Mr. Caird goes to show that after all, the ryot is not so very stupid as the average Anglo-Indian official supposes him to be.

We have Mr. Caird's evidence as to the severity of the late famine about Agra. The Famine Commissioner found "many poor villages in this quarter," and he says "the famine had been sore in the land." He visited a famine-stricken village in the neighbourhood of Secundra, five miles from Agra, on the Muttra road. He writes:—"On reaching the village where we had arranged a meeting, the people came out to see us and to lay their tales of misery before us. Their crops had failed, and they had no credit, and the native bunyias no money to lend. The death-rate had increased tenfold, and more were expected to die. * * * * And so silent are these people in their distress that the settlement officer, who had been two months encamped on the land, had not observed any particular poverty, nor had become either aware that the people were in a state of famine, or dying of it." And the Government of India after rigorously exacting the land revenue demand from these people, and doing almost nothing for them, is said to claim the North-West famine as the "best-managed" famine in India since the commencement of British rule! It is no wonder that the settlement officer did not observe the poverty, or become aware that the people were dying of famine. He knew well that Sir George Couper had determined that there should be no famine in his satrapy. So little indeed does the average European officials know the country they are called upon to rule, that if you ask them, says Mr. Caird, the condition of the people in any village or district, they can seldom tell you without making a special inquiry. This is the consequence of the *sukha* mania of the Government which administers the affairs of India. The merits of an officer out here are not judged by real, honest work performed by him, but by figured statements; and this, we need scarcely say, is demoralising.

No question connected with the administration of this country is more important at the present moment than the indebtedness of the agricultural classes. Mr. Caird briefly touches on this subject. He writes:—"The poverty of the cultivator makes him very dependent on the native money-lender. The first pressure that drives him to seek this aid is the prompt payment of the Government assessment. It is fixed for a period of years, and must be paid, whether the season is good or bad. If the season is bad, and the crop partially fails, he has no help but in the bunyia. * * * * The present assessment may be low, but in a bad year, when there is no surplus, a man with no capital has nothing with which to pay it." We have said that the real curse of the country is not the money-lender who, in bad seasons, enables the ryot to tide over his difficulties, but the vicious revenue system, which mercilessly exacts the assessment from the people, even when the crops have entirely failed in consequence of drought. Now that we are engaged in a crusade against the Soucar in the Deccan, it is interesting to read the opinion of an Indian High Court Judge of experience on the money-lender, as quoted by Mr. Caird. "The bunyia or native banker he considers a most useful class, who do not charge higher rates of interest on the doubtful security they receive, than are common in London, where bills of similar quality are renewed every three months, and charged five per cent. interest and five per cent. commission." If the Soucar were suppressed, the whole machinery for the revenue administration of the country would come to a dead-lock, unless, indeed, the Government be prepared to replace the bunyia by opening State agricultural banks and making advances to the ryot.

In dealing with the land and people of Eastern Bengal, Mr. Caird has occasion to refer to the relations between landlord and tenant, in that part of the country. He points out that in the existing state of things the landlords and their tenants fight their disputes out with the help of the courts of law, the tenants making up a common purse for the purpose; and then goes on to say:—"The law's delay, and the difficulty of dealing with large numbers of small tenants enable these to get the upper hand by uniting against enhancement of rents, and even against any rent, as the landlord is called on by the courts to show by his book that he has received the precise rent for five years back; otherwise they will not grant him a decree, thus casting the *onus* on him to show that he is entitled to rent." Mr. Caird holds that the united action of the ryots in withholding rent is a serious matter, and he is of opinion "that the less the Government and the courts of law interfere in the relations between landlord and tenant, the more likely are they to be satisfactorily arranged by the mutual interests of the parties." This is a matter on which it is not safe to express an off-hand opinion. As we said lately, the Bengal law contains every provision for the punctual collection of the land-owner's dues known to civilised jurisprudence, and the normal state of the Lower Provinces is marked by a struggle of the landlord to raise the rent. At present the landlord generally is able to realise not only the stipulated rent, but about twenty-five per cent. more in the shape of illegal cesses. The Bengal landowner has been asking a summary procedure not to enforce the existing rates, but to raise them without the intervention of the courts of law. And if the Government and the courts of law were to abstain from interfering in the relations between landlord and tenant, and to leave them to be arranged by the mutual interests of the parties, the days of *lattials* would probably be revived, and the ryot placed absolutely at the mercy of the zemindar. Of all questions connected with the administration of India, there is none more important than the law of rent, which affects the whole internal economy of the country, and the well-being of the vast majority of its working population; and there is at the same time no question upon which it is more difficult to arrive at indisputable conclusions.—*Statesman and Friend of India.*

WELL IRRIGATION.

We recently alluded to the belief, prevalent in some quarters, that a new era of agricultural improvement is about to dawn; it will be heralded—so runs the prophetic story—by an immense extension of official information on agricultural topics. We have our own reasons for doubting the complete realisation of these hopes, for the machinery relied on appears to us very doubtfully adequate, and there is much diversity of opinion as to who shall be the guiding spirit in the practical schemes of an enlightened future. The latter point is most forcibly illustrated by the great irrigation question. A new school has arisen, which looks to light railways for the salvation of the country; a still later development is the well irrigation theory; while canals, though not so implicitly believed in, as of old, still command vast respect and confidence. The case of light railways *versus* canals turns upon the hypothesis that India, as a whole, contains food enough to feed its population year by year, so that there need be no year of famine, if only means are provided for carrying the surplus of one district to supply the deficiency of another. This assumption contains a large element of truth. The scarcity of 1877-78 would have been far more severe in Rohilkhund, for example, had there been no railway to pour grain into the great towns and rural centres of the province. The traffic statistics of the Oudh and Rohilkhund line testify unmistakably to the services rendered in that disastrous time. In the matter of cost, the comparison between light railways and canals is all in favour of the former. The great expense of canals is often lost sight of in admiration of their benefits. Again, positive harm comes of canals in some places, where they soak the land sodden bringing out the sterile salts, and breeding fever, which kills off a large percentage of the population, and literally emasculates the rest. All these discoveries have been made since the principal Indian canals were constructed; they are so much experience which has been dearly bought; and they certainly form a fair ground for stopping and considering the matter a little, before committing the country more deeply to the system of which they are some of the results.

Wells on the other hand, come up with all the attractive hopefulness of a virgin subject. No salt plains, no water-logged fields, can ever be attributed to *them*; they will not generate malaria, nor chill the genial workings of Nature's chemistry with that 'cold' water for which the cultivator blames the canal. But wells, too, have their faults. They are expensive—it is said thirteen times as expensive as canals—and they have a trick of running dry at the most critical time, "summer dried fountains, when our need is the sorest." But the principal interest attaching to wells just now is with reference to the battle fought over them by scientific men and district officers. It cannot be said that the district officer is a very prominent figure in the picture of Indian agriculture, as it will be in a happy future. With difficulty can he be detected in the background, shrouded in the gloom of ignorance, surrounded by such horrors as license-taxes, poor-houses, revenue-reports. It is the scientific agriculturist who poses in the central lights of the piece, as a missioned spirit teaching the ryot the way to salvation. And when we come to wells, another shape intrudes,—that of the irrigation officer, who is naturally anxious that his experience should not be overlooked. He is the proper authority, it is said, upon questions of water level, exhaustibility of springs, comparative cost of well irrigation, and of other systems. The scientific agriculturist, on the other hand, is to decide whether water is wanted at all. These two gentlemen obviously leave the district officer nothing to do. The latter functionary is skilled neither in hydraulics nor in agricultural chemistry; his other duties are supposed to leave him no time for acquainting himself with the native processes; and any scheme of his proposing is sure to be fatally out from the scientific point of view. This is no unfair representation of the attitude of the scientific school towards district officers and their suggestions. The fact has been made known to the public (to take a single instance) by the controversy over the experiment of wells in part of the Moradabad district. In alluding to this dispute some time ago, as an example of the evils of excessive centralisation, it was perhaps overstating the case to [illegible] the [illegible] on the scheme by any [illegible]. The public now know that the views actually recorded were favourable to the experiment, strictly as an experiment on a small scale, in comparison with other experiments of tilling and watering. But the main question at issue, after all, is the [illegible] of the district or settlement officer, *versus* the scientific agriculturist and the hydrographer. And as this seems likely to be a question of importance in no remote future, we shall say a few words about it.

There is one person who seems to be left out of sight by the scientific school, and that is the agriculturist himself. Nobody appears to suppose that he has any right to be consulted, that he possesses any glimmering notion of his own interests. It has even been denied that he knows whether water is good for his fields or not. There is this much verisimilitude here, that the cultivator is indeed unreasonably greedy, nay, insatiable in his desire for water. He would have it flooding his fields and filling his village, even though fever should come with it. But then we must remember that his horror of drought is no mere fancy, but has been taught him by many trials of hard times, "fetching their proofs e ven from the very bone." When all is said, the question of water or no water, where well irrigation is proposed, must depend upon local experience and common sense—two qualifications which will not vainly be looked for, albeit, in rustic guise, among the peasantry on the spot. Existing wells are an obvious test of the supply of water, and furnish a standard of cost. The skilled hydrographer indeed must ascertain, if he can, the probabilities of the water-supply holding out all over the tract now for the first time to be extensively tapped. It would never do to leave out of consideration the chance of a general breakdown when the strain began in earnest. But the fault of the scientific school seems to us to consist not so much in giving undue prominence to the hydrographer, as in ignoring the district officer and the cultivator. Irrigation o fficers are no doubt brought widely and closely into contact with the agriculturist, and in fact they are left practically unfettered in all their dealings with him as regards canals; but there is something too technical and scientific in this intercourse, it is too much a matter of measuring up and calculating rates of water-tax, and is so far inferior to the relation in which the district officer stands to these same people, as the person who collects the revenue, enforces payments of rents, settles all disputes between landlord and tenant, often is actually the referee where the question is what the fields can fairly pay. If, however, the canal officer's relations with the agriculturist are less intimate and instructive than the Collector's, surely the agricultural chemist may be regarded as altogether out of the running. He is a useful and estimable person in his pro per place; but those are no friends of his who would drag him to a dry upland tract, cultivated by a poor depressed peasantry, and bid him there make experiments whether deep ploughing, subsoil drainage, and scientific manuring, will not obviate the necessity of irrigation and save the sinking of wells. If practical measures of relief or prevention are to be deferred till we have solved every possible question that can affect the welfare of the ryot, we shall run the risk of hearing the educated native apply to our policy the old proverb about the snake-bitten patient who would have recovered if he could only have lived till the antidote came from Hyrcania. Surely the elements of the problem are not so very complicated that we must begin with the Ram and the Bull; surely we can sink wells safely without waiting to try the results of breeding big cattle to draw English ploughs, "with a furrow like a causey," which shall render wells unnecessary. The dangers of undue generalisation are not less certain than those of local empiricism. Had local officers been listened to, some of the worst faults of existing canals would have been avoided, and if the recent lamentable experiences of the country have taught any lesson, it is that local remedies, local preventives, are the best means of dealing with or staving of famine. Here is a tract which can be protected by wells, if the water supply will hold out. Make sure of *that* point, and the rest is simply a question of cost,—how much can the State advance? In how many years will the landlord, or tenant repay? There is no necessity for inquiring whether wells will answer elsewhere; no call to

travel beyond [illegible] of the question. The question of principle, in the adaptation of various natural facilities to the [illegible]. Thus in one place well-sinking, [illegible] as we have repeatedly pointed out, small irrigation works from dams on rivers would prove a certain [illegible]; elsewhere, again, we must trust to light railways, or to the storing of water in tanks or closed ravines among the barren hills. Scientific assistance will be needed for every scheme; but it should be directed to purely practical ends, not to speculative experimenting with a view to possible results in some unpredictable future. And further, if anything is to be done, it must be done through the district officer. No greater mistake could be made than setting him aside as insufficiently versed in the agricultural sciences, and thus depriving those who should be his coadjutors, of a weight of authority and matter-of-fact experience which they will not find it possible to replace from any other source—not even from a Department of Agriculture and Commerce.—*Statesman and Friend of India.*

EDITORIAL NOTES.

LATELY an important question arose in connection with bonded stores. It seems some stores were landed in Bombay in Bond They lay there so long that they had become perfectly unmerchantable, and utterly unfit for use, and the question then arose. On these stores being condemned and destroyed for sanitary reasons, who should pay the duty, or should any duty be payable at all? The question was submitted to the Board of Revenue, who have decided that no duty should be charged on such goods. This may be a satisfactory conclusion for the importer, but we think it is hardly in accordance with equity and fair dealing. The importer evidently left these goods in bond because he could not find a suitable market, probably a profitable market for them. Had he found a very profitable opening, he would, of course have taken delivery, paid duty, and embraced the chance of the good market, and the revenue would not have benefited in any enhanced degree, beyond the receipt of the ordinary import duty, and since the merchant for his own purposes finds it perhaps cheaper to lose the goods, entirely than pay duty, and place them on a low market, we do not see how the revenue should suffer by the transaction.

IT is to be hoped that the planters of India; tea, coffee, cinchona, and indigo, will but lose sight of the Melbourne Exhibition of 1880. It is quite true that in the United Kingdom, we have a market extensive enough to absorb all we grow or can make of these products, but we must not forget that "competition is the soul of trade," and that new markets will tend to equalise the prices in London of these articles. In no part of the world does there exist better elements for a new market, especially for tea and coffee, than in the great continent of Australia. It is an island we are quite aware, but the great continent containing Europe and Asia has now been proved to be an island, we shall none the less continue to call it a vast continent. We trust therefore that tea and coffee planters will see that they are well represented at this forthcoming exhibition, and that the inhabitants of Australia may learn, what it seems difficult to teach those of our own land, that Indian tea—unmixed with China—is a vastly different production to the article usually vended as Indian tea at home.

THE rise in the tea and coffee markets must be particularly pleasing to shareholders, and to planters, for although these latter may not perhaps be interested pecuniarily to the same degree, we know they feel keenly when their manufactures do not meet with proper recognition. For a long time both industries have been groaning under low prices, and the late change must be all the more welcome on that account. We are a little surprised at the coffee market having been so much against Ceylon and the Wynaad planters, because the quantity these districts send to London, must be sufficient to influence the prices and in some degree steady the market, while the same cannot yet be said of tea, which only sends to London, 18 per cent of Home requirements, and we naturally expect the quantity and quality of the China article, to regulate to a certain extent the market for Indian teas.

THE use of the small hand sugar-mill patented by Messrs. Thomson and Mylne of Behea, is extending among growers of sugarcane in the Palamow sub-division, and thirty of these machines were sold last year. A similar machine for oil-pressing would doubtless be much appreciated.

"'Tis an ill wind that blows nobody good." For years past there have been loud complaints of the pestilent water weed known as *Elodea canadensis*, which it has sometimes been said is likely eventually to choke up our watercourses altogether. Now it appears that this same obnoxious weed is a valuable food for live stock. In consequence of its having been repeatedly observed that oxen ate the *Elodea canadensis* with great avidity, Dr. W. Hoffmeister recently undertook an analysis of the plant for the purpose of determining its comparative nutritive value. The results of his investigations are now published in *Fühlings Landwirthschaftliche Zeitun.* One hundred and fifty grammes of the weed yielded 18 grammes of dry substance, equivalent to 88 per cent. water, and 12 per cent. of dry matter. By Schulze's method 16·02 grammes of cellulose were obtained; the average proportion of protein was 18·46 per cent. Of the residue of an etherial extract, 0·15 per cent. was found to be insoluble in sulphate of carbon. The proportion of sugar was 23·02 and of starch 19·40 per cent. In order to estimate the substance soluble in an aqueous solution, a sample was thoroughly exhausted in cold water. The residue, when dry, reached 25·17 per cent., and yielded 2·89 per cent. of nitrogen, equivalent to 18·06 protein, showing that almost the whole of the albumen, has passed over in solution. Judged by the proportion of nutritive matter contained in it, the weed appears, therefore to be about equal in value to the best hay, or to a good quality of clover, and should, consequently, be well worthy of consideration as a food for live stock, where it is met with in anything like considerable quantities.

A NEW oil plant, says *Nature* (*Lallemantia iberica*) has been acclimatised on the fields of the Agronomical School at Cherson (South Russia). It belongs to the *Labiatæ* family, and is very similar to *Dracocephalum*. The herb attains a height of 1½ to 2½ feet; and bears some 2,500 seed-grains, which give a very pure oil, applicable even for culinary purposes. The seeds of this originally Persian plant were first sent to Cherson by Prof. Haberlandt, of Vienna.

THE *Giornale Agricoltura* gives the general results of a yet unpublished return on this subject, which has been officially prepared for the Italian Ministry of Agriculture. From this it appears that the average annual production of wine in the various countries is as follows:—France, 55,604,000 hectolitres; Italy, 31,500,000; Spain, 20,000,000; Portugal, 5,000,000, Austro-Hungary, 12,640,000; Germany, 6,501,000; Switzerland, 900,000; Russia and Turkey in Europe, 2,134,000; Greece, with Cyprus, 1,115,000; Roumania, 667,571. The total annual production of Europe is 146,121,646 hectolitres, or about 3,214,670,000 gallons. Since the invasion of the phylloxera in France, the average production of that country has fallen off by about 8,000,000 hectolitres a year.

WE learn from a Report on the Foreign Commerce of the United States that in South Carolina, in consequence of an apprehension, that rice grown in the Sandwich Islands, may find its way into the United States free of duty, and regarding this danger to their interest as imminent, some of the rice planters in that State have determined to substitute the cultivation of jute for rice, experiments having shown that the rice-fields are well adapted for this purpose; and the merchants of Charlestown, having become satisfied that jute can be successfully grown in that region, have decided to start a bagging manufactory, and thus to open a home market for jute, which is now exported into the United States to the extent of over 30,000 bales annually.

IT is stated in Regel's "Gartenzeitung," on the authority of Dr. Bretschneider, physician to the Russian Embassy at Peking that the Chinese raise weeping trees by reversing their extremities. Dr. Bretschneider describes the operation, which he asserts he has

himself repeatedly witnessed, as follows :—"To raise weeping trees of *Sophora japonica*, they plant two young seedlings side by side. The tip of one of them is then bent downward and inarched on the base of the other, tip downward. As soon as the graft has properly taken, the tree that was doubled down is dug up, roots and all, and the roots, denuded of the soil, turned uppermost, and the stem attached to a stake in this reversed position. The stem of the tree, which serves as stock, is then cut off at the point of union of the two, and the roots of the reversed tree form the crown of the artificial tree. In this novel position they require shading from the sun until they have formed some branches." In this manner, we are assured by Dr. Bretschneider, as translated in the *Gardeners' Chronicle*, the Chinese obtain all their weeping trees.—*Garden*.

A good deal of interest has lately been attached to a singular plant of Queensland and South Australia, known to the people as the Pituri, or, as it has been popularly spelt, pitcheri, pitchourg, or even Billgery. This plant is known to botanists as *Duboisia* or *Anthocercis Hopwoodi*, and belongs to the natural order Scrophulariaceæ. The leaves, it is said, are gathered annually during the month of August, when the plant is in blossom. They are dried, first by a process of straining, and then packing them in hemp bags for purposes of trade. To prepare pituri for use it is damped, mixed with ashes, and rolled up into the shape of a cigar, which the people chew, sticking it during the intervals of chewing behind the ear. The effect of the smoking of this novel cigar is very peculiar, rendering the smoker, for the time being, almost insane when indulged in too freely. When smoked in morderation, the leaves have a powerful stimulating effect, but the symptoms are somewhat similar to those produced by strong drink when taken to excess. The chewing of a small quantity of the leaves is said to assuage hunger, and a person so using them is enabled to undertake long journeys without fatigue and with little food.

COMMUNICATED AND SELECTED.

CARDAMUM PICKING IN COORG.

OUR correspondent from Mercara writes :—" Cardamum pickingin Coorg is being rapidly pushed on ; there is a very fair prospect of a large quantity and of good quality, and a month earlier than last year. It is now capital weather both for drying and gathering. For the latter, the undergrowth in the jungles is not so damp, and the dry weather is shrivelling up those pests, the leeches, which a fortnight ago were lying in wait for their prey. To dry the seeds great attention and care are required for the first few days, as they rapidly ferment and crack the pods, and scat tering all the spice unless well attended to by women, who must carefully turn them over on the mats incessantly. The price of this spice has risen considerably. A parcel of average Coorg cardamum is quoted in London this year at 5s. 6d. per pound, which is the highest I have known it fetch, though of course picked specimens would bring higher rates. At this figure it trebly repays the cost of gathering and local taxes, as cardamums are never cultivated, only preserved, coming up from the earth spontaneously, like 'Venus from the sea, where trees have been felled, or that have fallen down or blown over by the wind. Here, where the air and sun percolate, the cardamums flourish like a bed of lilies when they blossom in June, with large trailing shoots of flowers, of the size and fragrance of a white and purple hyacinth. Cardamum picking is one of the tasks besides attending cattle that a Coorg will engage in. He knows the unbeaten forests, and ranges over it in search of cardamums, and gathers about a bagful. This at nightfall is brought to a clearing place, where the coolies then bring it in ; the Coorgs only turn up when the work is done to get their money and brandy."—*Madras Standard*.

ARTESIAN WELLS.

AN experiment in sinking Artesian wells has been made in the Jardin d'Acclimation at Pondicherry, of which the results are considered, by the Madras Government, satisfactory enough to justify the construction of other wells in suitable localities. The Pondicherry well cost about Rs. 2,782, and with establishment charges, &c., the total cost would amount to Rs. 3,616. It gives a discharge of 23·52 cubic feet per minute, which is sufficient for the irrigation of nearly twenty-six acres, or in the Godavery Delta as high as twenty-nine acres. In Coimbatore, however, where water is used without any regard to economy, only half that area could be irrigated. If the water from such a well were utilized for eight months out of twelve, giving, that is, two crops, the area irrigated would be nearly 52 acres, and the cost of the water-supply Rs. 70 per acre. But the cost of the water-supply in the Godavery Delta was only Rs. 14 an acre, and the estimated cost of irrigation in the Kistna Delta is only Rs. 30 per acre, including drainage, &c. It is therefore clear that the cost of the Artesian well is too high to admit of the application of the scheme to ordinary irrigation. Such a well, however, would supply a population of 10,000 with 20 gallons per head per diem ; and for domestic use, therefore, for horticultural gardens, or experimental farms (such as Saidapet) the water would be most valuable, wherever, that is, a continuous supply is required all the year round. The difficulty of ascertaining the most favourable localities for the construction of Artesian wells has yet to be surmounted, and it is hoped the Geological Department will indicate where they may be sunk with some probability of successful results. In any case the experiment is interesting and worthy of the attention of our local Department of Agriculture.—*Pioneer*.

PALM OIL.

THAT portion of the West Coast of Africa which lies south of the River Volta, furnishes us with our principal supplies of palm-oil. Nearly a million hundred-weights of this oil are annually imported into Great Britain, of the value of over a million and a half sterling, its principal use being in the manufacture of soaps, perfumery, candles, and similar articles. Among the natives it is highly valued, both for food (taking the place of butter), for lighting and cooking purposes, and for anointing the head and body. The so-called oil, which is rather a fatty substance resembling butter in appearance, is obtained from the fruit of several varieties of palms, but chiefly from that of the species known as *Elais guineensis*, which grows in abundance on that part of the western coast of Africa, after which it is named. So thickly do these trees grow, and so regular and rapid are their supplies of fruit, that in some localities where the regular collection of the produce is not practised, the ground becomes covered with a thick deposit of the oily fatty mattter produced by the ripe berries. Deposits of palm " oil," which may almost be called " mines" of vegetable fat, exist in some parts of the Gold Coast which, if not in themselves worth working, at least practically illustrate the natural wealth of the country in such productions, and indicate its undeveloped resources. These " mines" would probably not repay the cost of exploration, as the palm-oil is apt to become rancid and valueless for its general uses after long exposure, though for such purposes as candle-making these deposits might still be valuable.—*The Colonies and India.*

THE HOP PLANT.

DR. EMIL POTT calls attention to the many useful purposes for which various parts of the hop-plant may be applied over, and above the mere production of the umbles employed in brewing, to which alone the growers' care appears to be given at the present time. To begin with, the tendrils furnish a good vegetable wax, and a juice from which a reddish-brown colouring matter can be extracted ; further, their ashes are greatly valued in the manufacture of certain Bohemian glass wares. Of still greater importance is the fact that a pulp for paper-making can be prepared from them, and though the goods thus manufactured cannot be satisfactorily bleached, very serviceable unbleached paper and cardboards are got from this raw material. The fibres can also be used in the manufacture of textile fabrics. Experiments in this direction extend to a far back date, and in Sweden yarn and linen making from hop fibres, has long been an established branch of industry, which is constantly increasing in importance and extent. The separation of the fibres has hitherto presented considerable difficulties, but these appear to be effectually overcome by the process recently devised by Dr. Weiss, of Neutomischel, of steeping them for 24 hours in cold water, containing 5 per cent., of sulphuric acid, or for 20 minutes in boiling water, to which 3 per cent. of the acid has been added. Other mineral acids, such, for instance, as muriatic, may be similarly employed. Nodlinger, of Stuttgart, also has patented a plan of rendering the fibres very flexible and tractable. This he effects by boiling them in closed vessels with soap and soda, and after thorough washing, treating them with diluted acetic acid, and then again washing in cold water. Another use to which hop twigs may be put is that of fasket and wickerwork. Lastly, it must not be forgotten that the young shoots form a very palatable vegetable, not inferior to asparagus in delicacy of flavour, while the leaves, and the spent hops themselves supply an excellent food for live stock generally, and especially for sheep. Dr. Pott, contends that by due recognition of some or all of these numerous virtues of the plant, growers can always repay the cost of cultivation without reference to the hop itself, which of course

will remain the chief object in view, and can render themselves more independent of the great fluctuations in the price of the latter, to which they are at present subjected.—*Journal of Applied Science.*

BUCKWHEAT.

THE name of this plant, or rather the grain of it, is derived from the German word *Buchweitzen*, "beech-wheat," from the resemblance of the seeds to beech-masts. It is not properly a grain, but belongs to the family of knot weeds of which there are several varieties in the North-Western States. "It is probably a native of China, but the time of its introduction into Europe is not well ascertained. It has been cultivated in England for about 300 years. It was introduced into North America by the Dutch early in the seventeenth century. Kalm, the Swedish naturalist, who visited that country in 1748, found it growing in Pennsylvania, New Jersey, and New York. There are three cultivated species—Common buckwheat, (*Polygonum fagopyrum*,) Tartarian buckwheat, (*P. Tartaricum*,) and notchseed buckwheat. (*P. emarginatum*). The first-named species is chiefly cultivated in America, the second in Italy, and the last in China. In Europe it is grown for food from Russia to Italy, Great Britain excepted. In the United States it can be grown in every section, but is chiefly cultivated north of North Carolina and Tennessee. The total crop in 1820 was 7,201,743 bushels; in 1850, 8,956,916, and in 1860, including States and Territories, 17,571,818. It will be seen by these figures that the crop of 1860 was nearly double that of 1850, showing a greater increase than any other grain crop. In Pennsylvania and New York the grain is used extensively for feeding sheep in winter, and it has been found so valuable for this purpose, that the crop has increased enormously since 1850.

Boussingault gives the following as contained in the grain (A), and the straw (B):—

	A.	B.
Water, per cent.	12·5	11·6
Nitrogen, per cent. dried	2·40	0·51
" " not dried ...	2·10	0·48
Ammonia, dried	2·94	0·65

In 100,000 parts of buckwheat straw Sprengel found 3,203 parts of ash, containing the following ingredients:—

Potash	332
Soda	62
Lime	704
Magnesia	1,292
Alumina	26
Oxide of Iron...	15
Oxide of Manganese...	32
Silica	140
Chlorine	95
Sulphuric Acid	217
Phosphoric Acid	288
	3,203

There is a striking similarity in the composition of buckwheat and rye. In the seeds of the former there is 27 per cent. of husk. The 73 per cent. of flour closely resembles that of rye in colour and properties, containing 10½ parts of gluten and 52 of starch. The greatest resemblance exists in the constitution of the ashes, when both plants have been grown on the same soil. The dried grain of rye contains 24 per cent. of ash, and that of buckwheat 21 per cent. Buckwheat is frequently ploughed in as manure for a wheat crop, for which purpose it is said to be, on some soils, fully equal to clover. Indian corn does not succeed well when it follows buckwheat, but on account of the soil being mellow and free from weeds, nearly all the cereals and root crops grow well after it. July is the month for sowing, but it can be sown as late as will enable it to escape the frost.—*Society of Arts Journal.*

EDIBLE FUNGI.

THE Japanese appear to understand, better than any other nation in the world the art of drawing tribute from the vegetable kingdom in the matter of their supplies of food. Dainty and nutritious dishes are prepared from materials passed over with contempt elsewhere, many common weeds, such as shepherd's purse, burdock, horsetail, fernbrake, &c., as well as several varieties of lichens and a large number of sea weeds, holding places of honour in their works on cookery. Naturally such a people have not neglected the merits of the mushroom and other edible fungi. These are largely consumed by all ranks of society, and the method of their cultivation is extremely curious. Instead of using beds of horsedung or tan, as with us, the Japanese grow their mushrooms on the trunks of trees of the Amentaceous order, those most commonly employed being the *Quercus cuspidata*, Thunbg., the *Quercus dentata*, Thunbg., and the *Quercus acuta*. The fungi grown belong exclusively to the Agaric order, and are apparently identical with our *Agaricus fusipes*, *Ag. cylindraceus* and *Ag. ilicinus*, or are at least very closely related to them. For mushroom-growing purposes trees are chosen of 15 to 18 centimetres in diameter. They are felled in October, and cut into pieces from 1·20 to 1·50 metres in length. Immediately after they are cut, the trunks are scored along the surface with a sharp billhook, the resulting cuts presenting the appearance of row of fish scales, and are then left to lie on the ground in a light, well-ventilated spot. Here they remain for fully three years, when the decayed ones are thrown aside, and only those selected for use whose woody fibre remains perfect. These are arranged on a frame work of strong beams, something in the same way as the rafters on a roof. The logs soon begin to be covered with the desired fungi, and in March of the following year the first corp is gathered. This is generally dried for future use. A few months later, about the beginning of August the logs are laid in water for half a day, then placed upon the ground and soundly belaboured with a thick wooden cudgel. They are then again arranged on the frame, and in two or three days the second crop of fungi begins to appear, and continues to do so for a considerable time. In the province of Tomoti the people declare that the size of the fungi is directly proportionate to the vigour with which the logs have been flogged. In this simple way enormous quantities of fungi are obtained, sufficient to allow a surplus of 400,000lb. for exportation in the dried form, after the home consumption has been amply provided for.—*Society of Arts Journal.*

THE POTTERY TREE.

AMONG the various economic products of the vegetable kingdom scarcely any hold a more important place than barks, whether for medicinal, manufacturing, or other purposes. The structure and formation of all barks are essentially very similar, being composed of cellular and fibrous tissue. The cell contents of these tissues, however vary much in different plants; and for this reason, we have fibrous or soft, woody, hard, and even stony barks. To explain everything which relates to the structure of bark would lead us into long details which our space will not permit.

Briefly stated, the bark of trees consists of three layers. The outermost, called the "cortical," is formed of cellular tissue, and differs widely in consistency in different species; thus in the cork oak, which furnishes man with one of his most useful commercial products, the cortical layer acquires extraordinary thickness. The middle layer, called the "cellular" or "green bark," is a cellular mass of a very different nature. The cells of which it is composed are polyhedral, thicker, and more closely joined, and filled with sap and chlorophyl. The inner layer (next the wood), called the liber," consists of fibres more or less long and tenacious. It is from the liber that our most valuable commercial fibres are obtained.

In some plants the fibrous system prevails throughout the inner, bark; but what we wish to refer to more particularly at present, is a remarkable example of the harder and more silicious barks, which is to be found in the "Pottery Tree" of Para. This tree, known to the Spaniards as *El caouta*, to the French as *Bois de Fer*, to the Brazilians as *Caraipa*, is the *Moquilea utilis* of botanists and belongs to the natural order Ternstrœmiaceæ. It is very large, straight and slender, reaching a height of 100 feet before branching; its diameter is from 12 to 15 inches; and its wood is exceedingly hard from containing much flinty matter.

Although the wood of the tree is exceedingly sound and durable, the great value of the tree to the natives consists in the application of the bark for a purpose, which, to say the least, is a novel one—that of the manufacture of pottery. The Indians employed in the manufacture of pottery from this material always keep a stock of it on hand in their huts for the purpose of drying and seasoning it, as it then burns more freely, and the ashes can be gathered with more ease than when fresh. In the process of manufacturing the pottery the ashes of the bark are powdered and mixed with the purest clay that can be obtained from the beds of the rivers; this kind being preferred, as it takes up a larger quantity of the ash, and thus produces a stronger kind of ware.

FIFTY thousand encalyptus trees are to be planted about the City of Mexico. These trees grow very rapidly, and in a few years, it is expected they will cause a very material modification of the rainfall about the Mexican capital.

CONCERNING the Australian blue-gum tree (*Eucalyptus globulous*), which has been planted by thousands in southern California, Professor Rothrock entertains the opinion that on account of its rapid growth, and its solid, close grained, enduring timber, it will be found more profitable to cultivate it, in many localities, than the cereals. He esteems its medicinal value however, very lightly, asserting the antiperiodic effects of its preparations to be much inferior to those of the preparations of cinchona. He recognizes the value of the tree as an effective agent in improving the sanitary condition of a moist and malaria-cursed district, because of its enormous evaporative duty. He recommends the planting of the Eucalyptus as of special value to the comparatively treeless districts of Arizona, New Mexico, and Texas.—*Journal of Applied Science.*

THE PALMYRA-PALM.

(By a Hindu Correspondent.)

"The palm-tree rears his stately head on high,
And spreads his feathery plume along the sky."

When writing these lines, the poet must have had in his mind's eye either the date or the cocoanut palm; for beyond the East Indies the palmyra is scarce, if indeed, any are to be found; neither can it be said by any degree of poetic license to "spread his feathery plume along the sky." It looks stately enough, especially when viewed in regular colonnades, as is often the case; but the crown wears a modest look, as compared with other palms, from the thick-set, clumsy, and parasol-like leaves of which it is composed. Leaving beauty aside, the palmyra will be found to serve a far greater variety of purposes than any of its compeers, so much so, that from the root to the topmost leaf there is hardly a part which does not minister to some comfort or convenience of man. Nor is its usefulness limited to some particular age or period of its existence. Before proceeding, however, to speak of its various uses, or of its peculiar manipulation to extract the toddy which is its main product, it would be just as well to say a few words respecting its tenure as property assessable, and paying revenue to Government. Prior to the settlement in Tinnevelly, which is pre-eminently the region of palmyras, it had been customary for Revenue Officers to inspect and take account of all assessable trees once every two or three years. In thus settling what each ryot had to pay, they used to, and do still, proceed on a three-fold division of all trees except seedlings and plants under six feet in height, *viz.*, the male tree, yclept *Kuttu*, which simply flowers, the female denominated *Parvam*, which both flowers and fruits; and the naturally barren or undeveloped tree, which neither flowers nor fruits, but yields a larger crop of leaves than the other two. This last is consequently styled *waste* or *Oleivettu* (leaf-cutting). Toddy is obtained from the first two varieties, but the female yields more than the male, and is on that account charged with the highest assessment of the three. Formerly, different rates of tax obtained in different places, ranging as they did from eight annas to Rs. 10 for every hundred trees; and among other improvements attributable to the recent settlement, I may point with satisfaction to the equalisation of these different rates, and the introduction of a new scale applicable to the whole district. From the descriptive memoir prefixed to the Survey and Settlement Register of Udeiyarkulum (Tenkarai Taluq), now lying before me, I gather that 18,183 trees now pay in the aggregate an assessment of Rs 652; the new rates being one anna and one pie for *Parvan*, six pies for *Kuttu*, and three pies for *Oleivettu*. Where the trees are held conjointly with the land, the amount payable for both is fixed once for all, or at least, until a fresh settlement shall take place. Under this tenure, the ryot pays no additional tax for young trees which subsequently arrive at maturity, nor is he prevented from cutting trees down or from adding to his holding by fresh sowings. The Puttah issued under this form of tenure is called *Saswata* Puttah (everlasting), and the trees are styled *Saswatapanai* in contradistinction to those held without the land. When the land belongs to Government or other parties, and the *Puttah* is held for trees alone, the holder possesses no right to fell them, or to claim compensation for trees cut down for public purposes, expect in the way of reduction of assessment. The tax, moreover is liable to enhancement or reduction after a periodical inspection and enumeration of all rateable trees, as was the practice prior to the settlement. In any case, no charge is made for seedlings and trees under six feet in height.

Let me now say a few words as to how the tree is propagated.

The usual method consists in burying the seeds or rather nuts in regular lines, in holes some eight feet, apart. In October or November, when the earth has been sufficiently saturated with wet, may be seen joyous little groups of men and women, carrying basket loads of nuts, and with a hoeman or two for each group. A single cut with hoe is often sufficient to excavate to the necessary depth, nor does the subsequent operation of covering up the seed entail any greater expenditure of time or labour. The nut germinates in a month, but it requires six for the first pair of leaves to appear above ground. In 5 years the tree generally attains a height of 10 or 12 feet, and in seven or ten it flowers and yields toddy for the first time. From this period forthwith, it both flowers and fruits every year, though the yield is great or small according as the season is favourable or otherwise. As a rule, the trees are left to shift for themselves as best they may, though it is an ascertained fact that occasional ploughing and digging round them, besides watering where the soil requires it, promotes their growth considerably. We are told they thrive best on light sandy soils near the coast, but at any rate they do not seem over-fastidious as to situation; since, in the interior, luxuriant groves may occasionally be met with on hard gravel or loose cotton loam, scarcely yielding in robustness to their seaside brethren

The first edible product of the palmyra is what is erroneously called root (Kilangu), but which is in reality the plant itself, root, parts, and all, after a three months' growth. The germ or first infantile leaf is in the centre, closed in by the next two succeeding leaves, the tender extremities of which, now so tiny and tapering together to a cone, subsequently expand into coarse, yellow skinned, fibrous stalks when they are above ground. In the fruit-season, which generally lasts from August to October, large quantities of nut are embedded in the ground in successive layers seldom exceeding three, and watered daily or every other day for a fortnight or so. Full three months elapse before the roots are dug up, and gathered not all at once, but according to the requirements of the family. The light leathery outer skin being removed (which is merely the bark in embryo), the root is either roasted or boiled whole, next severed into tiny little pieces with the hand, and eaten with a little powdered pepper and salt to give it relish. Not unfrequently the root is dried in the sun, either raw or boiled, till it becomes as hard as a bone. Among the poorer classes in Jaffna this is in much request, forming as it does their only mid-day meal, having first been ground into flour and boiled into porridge. Highly palatable when roasted or boiled, the root, when taken as porridge tastes like arrow-root or tapioca, which it doubtless equals in nutritive qualities. Along with the root or *Kilangu* is obtained, a curious grayish substance termed *Savan* which is simply the metamorphosed kernel during the germinating process. Thick and sweet when the sprout is young, but growing more doughy and aqueous as it strikes deeper into the soil, it is found in various degrees of tranformation within the nuts as they are dug up with or without the *Kilangu*; but whether sweet or insipid, solid or watery, the shells are cleft open as quickly as they are thrown up, and their contents swallowed without any ceremony.

The leaves are put to a variety of uses of which I can at best attempt a bare enumeration. They form an excellent thatch impervious to wind or rain, if only properly arranged and fastened to the roof. September and October are the months in which the leaf crop is gathered and disposed of, for it is only then that, the toddy season being over, the climbers have spare time on their hands, and the ryots think of rethatching their homes, in order to protect them against the North-East Monsoon. It is to be understood, however, that care is taken to leave untouched the central leaves—four or five in number—as also to deal gently with such trees as yield or promise to yield toddy the ensuing season. Foremost among its other uses, must be mentioned that from time immemorial the palmyra leaf has served as an excellent substitute for paper or parchment; the ancient literature of the country has been preserved to this day in palm-leaf books or as they are more generally called, *cadjan* manuscripts; in short, even now, in out-of-the-way places the leaf and style maintain their ground against paper, pen, and ink. Baskets big and small; buckets of different shapes and sizes, toddy jars, ditto; cloth receptacles, grain stores, curry stuff boxes, fancy ornamental trays, and salvers, sacks, seats, and cushions, fans, and parasols, mats, plain and ornamental, whether designed for bed, roof, or parlour, toys, strings, rope and cable—these are some of the multifarious articles made of palmyra leaf. The stalks yield coarse fibre inferior only to coir or the fibrous covering of the cocoanut shell, and which is put to almost every use to which the latter is applied. The most esteemed portion however is the yellow skin, which besides being made into ropes like the rest, serves as a substitute for rattan for caning chair and bed frames.—*Madras M ail.*

THE TRAFFIC IN AMERICAN GRAIN.

A LETTER in the *Times* from Mr. Joseph Price shows how the increased facilities afforded during the past ten years of transporting American cereals in bulk have placed the English farmer at a disadvantage as compared with the growers in the United States. Mr. Price says:—As the new wheat territory of Manitoba and the Red River country developes, this difficulty to the English farmer is more likely to increase than to diminish, and must lead to a large reduction in the rents of farms throughout Great Britain. It may be interesting to your readers to know how it is that the effect of this cheap transportation has had such an increasing influence within the last few years. Having been engaged in railway transportation as an officer of the American and Canadian railways for the last twenty years, if you will allow me, I will explain the matter.

There have been three great through routes of railways from the Atlantic coast to Chicago for about twenty-five years; but it is only a little over ten years that they have been in a position to carry grain in bulk without transfer. The reason was this: The usual gauge of the American railways was 4ft. 8½in., but the Canadian line forming the middle link of the north shore though route, north of Lake Erie, was 5ft. 6in. The other two routes south of Lake Erie passed through the State of Ohio, where the railways were all built of a 4ft. 10in. gauge which, in the wisdom of the State Legislature, it was thought would produce labour in the State by compelling the handling of all freight entering and leaving that State. In Canada, about ten years ago, the gauge was reduced to 4ft. 8½in., and in Ohio a compromise gauge of 4ft. 9½in. is used, which enables them to utilize their 4ft. 10in. rolling stock, while the tread of the car wheels of the connecting 4ft. 8½in. lines has been made broader. Grain in bulk is, therefore, comparatively a new through traffic which, from the necessity for two transfers on each of the through routes, did not previously exist. Each car contains about 350 bushels, and a train is usually made up of about 30 cars, making about 10,000 bushels per train. The through rate from Chicago to New York is from 7½d. to 15d. per 100lb. of grain, according to the competitive propensities of the various routes. The value of land, therefore, in the Eastern States will be the price of prairie farms *plus* the carriage I have mentioned, and in England it will be that *plus* the ocean freight Elevator and transportation facilities are increasing all the while

and of course cost of living and taxes are much below what they are in England; therefore, landlords in Great Britain will be obliged to recognize the situation, or I think the farmers will be quite unable to weather the storm.

NOTES ON CHICLE.

THE great interest in the search of substitutes for India-rubber and gutta-percha, which for some time past has been manifested by technical men, has led us to an examination of a Mexican product, known in the United States for a number of years under the name of *Chicle* or *Sapota*. The latter name would imply that the product was derived from one of the many species of Sapotaceæ, one of which is pointed out as the tree furnishing Balata. With the latter product it shares in fact many qualities, the general description given of balata seeming to apply directly to the product under examination. Balata is the concrete juice of a tree variously called by botanists *Mimusops Balata (Gaertn) Achras balata, Achras dissecta*, and sapota *Muelleri*, a Sapotaceæ which grows in British Guiana, while hicle is said to be the product of a tree of the same class from Mexico. The difference in the manner of obtaining the material is evident from the chemical composition. While balata is an almost pure hydro-carbon, with its various products of oxidation, chicle contains also the various impurities of the juice from which it is derived.

The only reference to chicle that could be found was by J. R. Jackson [Ph. J. & Tr. (3) vol. 7, 409]. He gives a general description of the material, stating that it resembles gutta-percha in appearance, being however, more friable and brittle. He further mentions that it is, probably derived from *Chrysophyllum glycyphlœum* of the family Sapotaceæ, and that it is also known under the names of Mexican gum and rubber juice.

* * * * *

The material examined was in the shape of rectangular cakes, of light chocolate or flesh colour which was more pronounced on the surface, where atmospheric influences had acted more powerfully. The substance can be crumbled between the fingers; it has, however, a certain degree of softness and tenacity which is more perceptible after the material has been heated. Taken in the mouth, it disintegrates unites again, however, after chewing, then forming a soft plastic mass, this latter quality has probably made it a favourite material for chewing gum. On heating, it first involves a sweet caramel odour; after this has disappeared, the peculiar smell becomes preceptible, which is generated when caoutchouc or gutta-percha are treated in like manner. The material disintegrates if it is boiled with dilute acids; the brown solution contains oxalic acid and saccharine matter. The residue, subsequently boiled with dilute solutions of caustic alkalies, unites again, and then forms a doughy mass.

The following constituents have been found :—

Chicle resin or gum, forming 75 per cent. of the crude material; oxalate of lime (with small quantities of sulphate and posphate), 9 per cent.; arabin, about 10 per cent.; sugar, about 5 per cent.; salts, soluble, in water (chloride and sulphate of magnesia, small quantity of potash salts), 0·5 per cent. All these figures are only approximate.

Chicle Resin or Chicle Gum.—The resin, in the crude material, can be completely separated from the other constituents by bi-sulphide of carbon. If the finely divided material be shaken with about twice its weight of bisulfide of carbon, it will swell and assume a dark chocolate colour. After standing for from two to three days, the insoluble residue will settle, leaving the yellow supernatant liquid perfectly clear. By carefully siphoning off the solution, and treating the residue with fresh portions of the solvent about ten times in the same manner, the resin will be completely removed from the insoluble residue, and obtained free from the other constituents of the crude product. Towards the end, when the solvent contains only little insolution, the insoluble residue will settle only very slowly. After distilling off the larger portion of the bisulphide of carbon, and pouring the residue into boiling water, the resin is obtained as a very light resh-coloured doughy, tolerably fluid mass, which is heavier than water. On cooling, it becomes hard, and then assumes a wax-like consistence retaining, however, a certain degree of elasticity as long as it contains water or bisulphide of carbon. Dried at 100° C., it presents lumps, of somewhat granular appearance, which are light yellow inside, darker on the surface. They are brittle. Vulcanised at low temperature and with sulphur, the resin becomes elastic; at higher temperatures and with more sulphur it becomes hard and brittle. The dried resin dissolves easily in bisulphide of carbon and cold ether, only partially in boiling alcohol. For reasons which will appear hereafter, the above method of obtaining the resin is objectionable, if its further examination is contemplated. Another method for obtaining the resin, at least free from arabin, the soluble salts, and the larger part of oxalate of lime, is by boiling the crude material with water. It then presents chocolate-coloured lumps, with properties similar to those described in the resin, arrived at by the other method.

Vulcanised products.—The chicle resin, obtained by bisulphide of carbon yields, on exhaustive treatment with boiling alcohol, a light grey residue which dissolves readily on digestion with boiling ether. Only a very sligh floccular precipate remains. The clear light yellow solution thus obtained gelatinizes to a mass of white crystals upon cooling and standing. Evaporation of the mother liquid, obtained by filtration, yielded a residue which on drying at 100 degs., presented a light brown, slightly transparent elastic mass. This residue was almost utterly insoluble in ether, naphtha, bisulphide of carbon and chloroform, even on boiling. It becomes gelatinous, translucent, and light yellow on digestion with ether, and swells to about twenty times its original bulk, and only very little is dissolved. This peculiar behaviour at once suggests that the residue may be a vulcanised product, which was fully confirmed on farther examination. A portion of the substance, which had been repeatedly treated with boiling ether and alcohol, and then dried at 100 degs., proved to contain 1·77 per cent. of sulphur and about 8 per cent. of oxygen.

The waxy mass obtained by drying the previously mentioned white crystals at 100 degs., after they had been thoroughly washed by cold ether, and pressed between blotting paper, consists largely of the insoluble hydro-carbon, but contains also a similar vulcanised product which remains behind undissolved on digestion with boiling ether.

The source of the sulphur in the vulcanised products is readily comprehensible. It is a well-known fact that bisulphide of carbon will alter on standing, exposure to light and air, and then contain free sulphur. (Compare also, Gmelin, "Handbuch der anorg. Ch.," 6te Aufl., vol. 1. (2) p. 324.) The complete extraction of the chicle resin from the raw material is naturally a lengthy operation, and atmospheric influences on the bisulphide, have ample time to exert themselves. Hence the hydro-carbons were obtained first contaminated with sulphur, and finally in a vulcanised condition.

The descriptions given of gutta are somewhat conflicting, and it has been assumed that gutta-percha may exist in different modifications. The presence of these two modifications, in the same sample, has never been proved.

The properties given to gutta by various authors are such that they seem to describe as gutta, either a hydro-carbin soluble in cold ether, or a hydro-carbon soluble in warm, but insoluble in cold ether.

From the manner in which these investigations were made, it remains doubtful whether the authors, after finding, really looked for another hydro-carbon.

The hydro-carbons found by us in chicle correspond, in many respects, to these different guttas, and must be classed in the same group with them, if they are not actually identical—a fact, the proof of which would have necessitated a direct, comparative examination of guttas from various sources.

The crude chicle contains, besides 75 per cent. of chicle resin :—

Arabin	10 per cent.
Sugar	5 „
Soluble inorganic salts	0·5 „
Oxalate of lime (sulphate and phosphate) ...	9 „

From this it is evident that chicle is merely the product of direct evaporation of the juice, without attempt of separation, as is practised in the case of gutta-percha and India-rubber. There is no doubt in our minds, that by proper treatment of the raw juice, a far more valuable product would be obtained than the chicle gum which is now in the market.

Whether the product then obtained, will be one similar to gutta-percha, balata or India-rubber, must be left to future examination of the raw juice, which so far, we have been unable to obtain.—*Geo. A. Prochaska, Ph. D. and H. Endemann, Ph. D.*

ON THE VARIETIES OF COFFEE, AND THEIR COMMERCIAL ESTIMATIONS.*

THE exact determination of the source of any kind of coffee is a very difficult matter, and requires considerable knowledge, practice and experience. The form, the size, and the colour of the seeds serve, at the ports of arrival, as a fair criterion for establishing a first classification, but certain kinds undergo a second triage or assortment when imported, or with the dealers, hence the various kinds of coffee consist of a great many varieties.

The estimation of the commercial value of coffee, therefore depends chiefly upon characters drawn from the place of production, the form, size, colour, smell, flavour, age, and uniformity of the seeds; also on the presence or absence of foreign substances, such as dust, stones, stems, &c. The source of production, when known, is usually a good index, but even then there is always to be found some difference according to the nature of the soil; the season, the state of ripeness of the beans, their mode of extraction and preparing. Thus arid soils yield better qualities than low or humid ground. Berries which have been decorticated by means of a mill, and then dried in the sun, are better than those which have been first soaked or prepared by desiccation and triturating the fruit.

The general form of the berry is not always a safe criterion for determining the source of the coffee, for forms of different kinds will often be found in coffee of the same origin.

Thus, for example, Santos coffee possesses characters common to that of India, Oceanic, and some sorts of West Indian and Bourbon coffee beans have sometimes a pointed extremity, and at others a rounded end.

The different forms of beans may be ranged under three principal types, represented by Mocha, pointed Bourbon and Martinique. The first is small rounded and rather rolled; the second is of medium size, elongated and pointed; the third is large and flattened. But it must not be overlooked that in each of these sorts we find besides the typical form, the two others

*By Dr. Georges Pennetier, Rouen.

as additions, and in some rare exceptional cases, the coffees of all sources are found to have a mixture of these three forms, produced on the same plant. M. Leon Marchand * tells us that "M. Breon, former representative of the French Companies at Bourbon, has seen the planters sort or class the berries from the tree during the collection. This triage offers no difficulty. The fruits at the extremity of the branches only produce the Mocha form, those from the axis the Martinique form, and the intermediary fruit the Bourbon kind. The grains diminish in size from the commencement of the branch to the end. This decrease in size appears to be the result of a marked abortion. These facts explain and are in accord with the theory which asserts that the nourishment becomes less strong in the branch towards the extremity.

The progress of cultivation leads to a predominancy of the plano-convex form, which is the normal character of the seed, and the Mocha carefully collected after some years, furnishes a proportion more and more considerable, of flattened beans. The rounded and selected seeds constitute the round coffee of the Creoles, the caracolello of the Spaniards, and the peaberry coffee of commerce.

Occasionally a good estimate may be drawn from the convex or crushed shape of the dorsal face of the seeds, of the flat or excavated form of the opposite face, also of the disposition of the longitudinal sillon which is straight or largely open, and of which the inferior extremity encroaches more or less on the dorsal face. This is also the case as regards the size of the seeds, which measure from nine to twelve millimetres long by six or eight broad. Some coffees, as Brazil Martinique, and Java, present an equality of size of bean, a pretty fair regularity, but this is not the case with those of Hayti, San Domingo, and Mocha, in which will be found beans of different sizes. As a general rule the sorts which have the finest flavour are those where the bean is of medium size.

The very variable difference in the colour of the seeds results from different causes, such as the nature of the soil, climate, degree of maturity of the seeds, their mode of extraction, age, and kind of preparation. Coffee grown in elevated lands is of a light colour, while that raised in in low and humid localities has a darker hue. The berry is green when it has been extracted by maceration of the fruits; yellow when it has prepared by trituration after complete drying, and usually greenish yellow when it has been "gragé" or prepared by the mill. It is, in fact, of a more or less lightish-yellow, when it arrives in a season tolerably dry. The colour of the beans may differ considerably in the same kind of coffee, and if some are, in this respect, sufficiently alive, the shade of others, such as Rio and Santos, will vary considerably, being sometimes of a beautiful golden yellow, at others green, blue, grey, or blackish.

Generally the coffees of the old continent and its islands (as Mocha, Bourbon, Ceylon, Java, &c.) are yellow or greenish yellow, while those of American origin (as Martinique, Guadaloupe, Hayti, Brazil, &c.,) are green.

The greater part of the coffees, those of Hayti especially, which are most esteemed by consumers, have when fresh, a sweetish odour and a very pronounced raw flavour. Coffee improves considerably by age, and is never really fit for consumption, until it has attained a proper state of dryness. This it attains by natural desiccation and only acquires after at least five years of keeping; or else by means of artificial drying (stovage and ventilation) the beneficial results of which have been well pointed out by General Morin.†

The weight of coffee depends greatly on its state of dryness. Hence Morin tells us "the driest coffees, the colour of which is in general a pale yellow, have a density, by measure, determined without heaping up, of about 600 grammes to the decimetre, while those of a greenish colour, and which have only been gathered about one or two years, will weigh on the average from 680 to 706 grammes or more to the cubic decimetre."

The odour *sui generis* of certain coffees will furnish a good test, but in most cases this needs great experience to apply it.

Green Mocha has an agreeable odour somewhat resembling that of tea. The coffees of Martinique and Jamaica have a pure pleasant smell, that of Porto Rico is much less agreeable. The odour of Brazil sorts is generally strong, without being always the same, because it is by this character that Rio and Santos coffees can generally be distinguished. Those of Java and Sumatra are penetrating or sharp, and that of Manila is very pronounced.

The taste and flavour constitute another special characteristic. That of Mocha is the best of all, Martinique coffee is very agreeable, while the coffees of Guadaloupe and Porto Rico are less so. Padang coffee is not so much esteemed as that of Java; Sumatra coffee is slightly bitter.

Green coffee mostly arrives in commerce mixed more or less with broken berries, *débris* of husks, mouldy beans, and foreign substances such as dust stones, bits of wood, and various seeds. It requires, therefore, in examining different kinds of coffee, to have this element in view.

The coffee of Hayti, for example, contains a larger number of broken beans, dust, and a greater quantity of stones than that from any other quarter. The coffees from Rio, Santos, Martinique, and Java, are generally, on the contrary, well prepared, clean, and contain few foreign matters. Other sorts, as from the Cayes, Singapore, and Macassar, have usually many mouldy beans.

The stones found, will necessarily correspond with the geological formation of the country where the coffee is grown, and hence differ notably. Those of Brazil, for example, will in no wise resemble those of Hayti, the stones of Santos are of a brick red colour, friable, and of dimensions varying from a pin's head to a hazel nut, whilst those of Rio are generally white, crystalline, sharp, of various sizes, and will scratch glass.

The stones of Hayti (Port-au-Prince) are greenish-grey, and ranging in size from a grain of sand to a large nut.

Hence the stones and earth found mixed with the coffee may give some clue to the source of growth, but this can only be on first arrival, for dealers usually mingle one kind with another.

Besides the stones, the imports carefully prepared of Rio and Santos coffees contain little bits of wood, pieces of the boughs or branches of the coffee tree.

Finally, in a commercial appreciation of the various kinds of coffee, account must be taken of the relative proportion of *cafeine* which they contain, but this determination necessarily requires careful chemical analysis.

Messieurs Robiquet and Boutron found the following proportion in 500 grammes:—

	Grammes.
Martinique	1·79
Alexandria and Java	1·26
Mocha	1·06
Cayenne	1·00
St. Domingo	·89

—*Journal of Applied Science.*

(*To be continued.*)

SWISS AGRICULTURE.

It may be some slight consolation to the agriculturists of England to know that they are not alone in their misfortune, and that their cries of distress have found a sympathetic echo in a country so far away and so differently situated as Switzerland. Letters have lately appeared in many Swiss papers bearing a striking resemblance to those on this subject which have been printed in *The Times*; and one of your leaders and Lord Huntly's recent speech in the House of Lords have been translated and much commented upon by some of the principal journals here. The complaints of Swiss agriculturists have reference less to bad seasons and short crops, than to dear labour and foreign competition. Young men they say, do not remain in the country, as their fathers were wont to do; they prefer the life of towns they wander away to other lands; wages as a consequence, have risen, while the prices of agricultural produce have fallen. The warehouses of Romanshorn are crowded with Austrian and Hungarian corn and flour, and even the *Heusegen* (bountiful hay harvest) of 1878 has proved a doubtful blessing, for milk is selling in North Switzerland, at 11 centimes the litre (equal to about 1*d.* for 1¾ pint), and butter at 10*d.* per lb.; and heavy importations of American cheese have made the home cheese industry a losing business. An attempt was lately made to introduce the beetroot culture into canton Aargau, and it was proposed to turn the monastery of Muri into a sugar factory; but when the matter came to be thoroughly investigated, under the direction of Dr. Kramer, of Zurich, a great authority in agricultural matters, it was found that while the highest price obtainable for the root was one franc per cwt, it could not be grown under a cost of 1f 80c. to 1f. 60c. the cwt., so the project had to be abandoned. It is rather remarkable that, while the English farmers are complaining of the effects of game laws, Swiss farmers are suffering greatly from the absence of similar enactments, and the inevitable extermination of small birds which comes of free and promiscuous shooting. True, most of the cantons have lately passed laws prohibiting *la chasse* during certain months of the year; but as yet, the balance of Nature is far from being restored, for a Swiss "sportsman" kills every live thing he sees that is neither human kind nor strictly private property—larks, thrushes, robins, sparrows, and even hedgehogs, and owls; and the "hunter" who rolls over a fox is as proud of his achievement as the Indian shekarry who puts a bullet through the head of a Bengal tiger. One notable consequence of this indiscriminate slaughter is that some districts are every autumn literally overrun with field mice. In one commune of Zurich alone, 80,000 of these pests were killed last autumn; and the *Maikäfer* (May-bugs) have greater terrors for the Swiss farmer than either dear labour or foreign competition. The damage they do is enormous; individual communes have been known to pay as much as 4,000*l.* in premiums for their destruction in the course of a single year. In 1876 the district of Meilen (Zurich) paid in this way 6,000*l.*, and the *Maikäfer* caught and destroyed 1,040 hectolitres (22, 880 gallons). Birds are justly considered to be the most formidable foes of these destructive insects, and it is significant of the importance which is beginning to be attached to their preservation in Switzerland, that the Swiss Society for the Protection of Animals has just addressed a Latin letter to Leo XIII., imploring him to use his great influence in favour of the birds "massacred in enormous quantites in Italy and elsewhere, to the great detriment of agriculture." The society are of opinion that a solemn exhortation from his Holiness will have a more powerful effect than either the warnings of the *Press* or the terrors of the law. The letter will be forwarded to the Pope through the intermediary of the Federal Chancellery.

Much has been written of late in the *Times* and elsewhere touching enterprise in agriculture, and the style of living practised by English farmers. In these respects Switzerland is the antithesis of England,

* Recherches organographiques et organogéniques sur le *Coffea Arabica* Paris, 1864

† Notes sur diverses variétés des Café et en particulier sur les cafés de Brésil. Annales du Conservatoire des Arts et Métiers.

Whatever other advantages small properties may possess, they do not so far as this country is concerned, appear to develope a spirit of enterprise in those who own and cultivate them. Reaping, or mowing, or haymaking machines are rarely seen in Switzerland, and though winnowing machines are in common use, so also are the thrashing-floor and the flail. Old-fashioned ploughs requiring the services both of ploughman and driver, and often of a small boy, are still in vogue, and the methods of farming are generally slovenly and backward. But it must be admitted that what these people lack in enterprise they make up for in thrift, and that, dispite the slowness and the antiquity of their ideas, they have the keenest of eyes for the main chance, and a wonderful knack at money-making. It often happens that peasant proprietors, whose outward appearance indicates a condition bordering on poverty, and who, together with their wives, work harder than any of their hired servants, are worth in flocks and herds and real estate, £5,000 or £6,000, to say nothing of savings banked and out at interest. But, with the exception of such pleasure as the sense of ownership bestows, their lives are hard and joyless, and there are probably few persons who would not prefer the life of the English farmer, with his hunters, his sherry, and his piano, even with his present troubles thrown in.

With a view to lightening the pressure of hard times and in the hope that they may thereby secure a constant supply of cheap bread, the people of Zurich, or rather a part of them, are proposing to make the State a dealer in grain. They desire, in fact, to establish in their canton the system which wrought so much evil in France in the last century, which was denounced by Turgot more than 100 years ago, and abolished at his instance in 1774. A law carrying out this idea has been prepared and will be submitted to the popular vote a few weeks hence. It will be interesting to watch the fate of this project, for, by a grotesque coincidence, its promoters, who are among the most advanced of Swiss politicians, are at the same time the strenuous supporters of the *Culturkampf* and ardent opponents of the restoration of the punishment of death. This party, though at present rather under a cloud, is still very powerful, and its ideas may be an important factor in the political future of Switzerland.—*Times.*

AGRICULTURE IN INDIA.

THOUGH the many attempts that are being made to improve the farming of the cultivators in India, are not so successful as we could wish, there is no reason to despair. It takes a long time to overturn old and settled habits in any people as many of us must know, who can look back a few years on the changes that have been wrought in the farming of Britain, especially of the Highlands of Scotland. The marshes and bogs have been drained, causing a great change of climate, and a cessation of the yearly ruin which usually fell upon the farmers in frost-bitten potatoes and blighted turnip crops. On hill-sides where nothing but heather and bracken used to flourish, we see the hardy barley crops, and fine fields of grass. Much waste land has thus been recovered in the Highlands during the past thirty or forty years, to say nothing of the improvement which scientific drainage and manuring have brought to the land formerly under cultivation. To put aside all improvements because they are not liked by the people, or because they make very slow progress, is very unwise indeed. Everything has a beginning, and most improvements are ushered in by a series of disappointments. But patience and perseverance are necessary to secure success. Perseverance is absolutely necessary if we would have new machinery introduced into India. Our earliest remembrance of Poona is 1845, when we were taken to see the country all around this station—to Kotrood, Moondwa, &c. We were surprised to see out on the fields, in various places, English ploughs going to rust and ruin. On inquiry we found that these ploughs had been brought out from England and distributed gratuitously among the farmers. The poor farmers had never been taught to use them, and though they had purposely been made light to suit the small Deccanee bullocks, the people soon cast them aside for their old Indian plough, which merely scratches the surface. We do not know what finally became of these ploughs, but, when we last saw them, they were in the fair way of falling to pieces. If there had been any one to take an interest in teaching the ryots how to use these ploughs, and to encourage them to persevere in using them, these forty years might have witnessed a great improvement in the condition of the ryots in our neighbourhood. Deep ploughing is an economy of labour, and gives less work to the ryots than the present scratching of the soil. It is, we grant, impossible to get the ryots to adopt high cultivation all at once, but they might easily be induced to make such minor improvements as would greatly improve their condition, by multiplying the yield from their fields. The *Madras Mail* we are glad to notice, is directing attention to the improving of the implements of the farmer. Though our contemporary considers that the capital required for the high cultivation advocated by some is more than the ordinary ryot can possess, and that to aim at introducing perfect cultivation would be absurd, yet very little capital is needed to effect an enormous improvement of the present system, and no new appliances, except an iron plough, are acquired beyond a few simple tools, which may be made in any village. It will perhaps be unexpected intelligence that deep ploughing costs less than shallow ploughing in most soils; such is, however, the case. Deep ploughing is also broad ploughing and by going once the length of the field, a deep plough, turns up twice as broad a sod as a shallow plough, and consequently one-half the number of trips will be enough to plough the field. Deep ploughing has many advantages. In the first place, it is evident that more plant-food can be yielded by soil eight inches deep than by soil only four. Again, deep ploughed soil, better broken up, can be ploughed a month earlier than shallow. It is also more spongey, and retains moisture a month longer than the shallow, thus lengthening the season by two months, a matter of vast importance of which every one knows. The other advantages of deep ploughing are too many to mention here, and the cost of a plough made at the Bangalore farm, is only thirteen rupees, an amount not beyond the resources of any ordinary ryot. Objectors say further that manures cost too much for the ryots. Guano or superphosphate may be too expensive. An ordinary bullock gives about three bandy loads of solid manure per annum, but if properly bedded, the liquid manure, now mostly lost, may be made to produce forty bandy loads of manure, worth sixty loads of the solid. A ryot, without any expenditure except bedding, with materials produced on his own land, may obtain twenty times more manure than he does at present. There are innumerable methods by which crops may be largely increased, with scarcely any cost, beyond that of teaching the ryots a few simple facts. We feel sure that all that is wanted to make the ryot adopt an improved system of cultivation is the encouragement of his own people, and the higher *classes of Hindoo society.* If the members of the Sarvajanik Sabha would only devote half of their time and opportunities to practical purposes, such as going about in the country and getting the ryots to adopt the simple improvements which are within their grasp, they would earn from Europeans and natives alike the proud title of public benefactors. In the Highlands of Scotland, with which we are well acquinted, there was here and there one farmer who dared to be singular, who drained his bog land and his marshes, sowed his hill sides with barley and turnips, and not only took pains to preserve and increase the manure of home manufacture, but brought bone dust and guano from afar. His land brought forth double the produce of former times, and soon his neighbours followed his example. We know of one farmer in Perthshire to whom his neighbours presented a handsome gold watch in acknowledgment of the benefits they had received from his advice and example. Mr. Marman of the Bangalore Experimental Farm had faith in the ryots of Mysore, when he started on a tour among them, taking specimen ploughs with him. A certain distinguished person, we are told, said that if he sold three it would be a miracle. He sold three hundred, and got paid for them too. The ryots came in thousands to see the new ploughs at work, and he might have sold many more, but great are thy wonders, oh red tape!—the annual allotment for plough-making was exhausted, and sanction could not be granted for any excess. Such is the story of the iron plough in Mysore. What is required is, that any village offering to cultivate on improved principles should be allowed their land free for three years, and then be allowed easy terms for one. This must be started with a whole village. One individual working by himself would be disheartened by the evil predictions of his neighbours. If this method were adopted, the wealth of the country would, in all probability, be soon doubled. *Irrigation is all very well in its way, and the tanks in Mysore are* a source of great wealth. But in famine years, there is no rain, and just when they are most wanted the tanks are dry. Hence the necessity for an improved system of agriculture, such as that which it was the aim of Government to introduce, when they founded Experimental Farms. The danger is that we expect too much at first from the pupils of the agricultural schools, and the ryots who adopt the new system of ploughing. Encouragement is wanted, and we should be glad to see the members of the Sarvajanik Sabha devoting themselves to the work of trying to improve the cultivating class—the most important class of the community. —*Deccan Herald.*

THE TEA MARKET.

ACCORDING to the Custom House returns, the total quantity of tea delivered from the bonded ware-houses in London during the week ending 18th October, was 4,520,915lb., or 116,784lb., and 2½ per cent. higher than in the previous week. The amount taken for home consumption was 2,673,612lb., for coastwise removals 1,009,232lb., for exportation 768,491lb., for immediate exportation 69,721lb., and for ship's stores 4,858lb. The duty received was £66,840, being an increase of only £17 on the payment of the week ended with October 11th. Messrs. J. C. Sillar report a very firm market, even signs of excitement manifesting themselves. The market is almost swept of old season's. Telegrams from China report the shipments to this country on the 10th instant at 116,000,000lb. Last year, according to written advices from the ports to Hong-Kong, at that date they were 137,197,000lb.; about 8,000,000lb. have also been sent to the Continent this year. "It is impossible to form an exact estimate of the quantity that may still be brought to the shipping ports in China during the remaining months of the year, but it is improbable that more than one-half of the present deficiency—if so much—can be made up, even if the Chinamen prepare old leaves. The future prospect is, therefore, very serious. The following figures show the statistical position on the 30th ultimo, but the official accounts of the Custom House do not include the quantities transhipped in their statement of deliveries. These amounted to 6,764,496lb. on the 30th ultimo. If in estimating the total supply we take the total shipments from China and India for this country, we must also include in the deliveries the quantity transhipped. The total quantity delivered from the 1st January to 30th September last, therefore, really amounted to upwards of 159,000,000.

According to the most trustworthy information at our command, the present rise has come too late to enable the Chinese to prepare more teas for this market during the present season; the fourth crop has all been gathered; and it now appears highly improbable that the total shipments to this country will exceed 155,000,000lb. If we add to this 38,000,000lb. of Indian tea, we shall have a total supply of 193,000,000 to meet a total demand of about 210,000,000lb. The action of importers early in July last, in throwing away their fine congous, has had the natural effect of checking shipments from China, and has to a great extent led to the scarcity which we are sure to feel for eight or nine months still to come. Even now the importers, as a rule, are too timid to resist the fraudulent sale terms, and gambling to a large extent is going on. The official accounts of the Custom House have been published for the nine months ending 30th September, and show the following figures for the last three years:—1879 import 120,441,000lb., home consumption 122,229,000lb., export 30,091,000lb. total delivery 152,320,000lb., stock 30th September 83,733,000lb. 1878 import 145,430,000 home consumption 120,108,000lb., export 28,122,000lb., total delivery 148,230,000lb.; stock 30th September 107,226,000lb.; 1877 import 121,776,000lb., home consumption 113,165,000lb., export 24,190,000lb., total delivery 137,355,000lb. stock 30th September 95,681,000lb."—*Statesman and Friend of India.*

SAVE ABSORBENTS FOR THE STABLE.

IT is a good time now, while the weather is comparatively dry, to collect and lay up dry soil to use in the stables for absorbing the urine which would otherwise be partially or wholly wasted. Loam, dry muck, sand or sawdust may each be used with advantage for taking up and holding the liquid excrements of the stable. That substance will be the best which can be obtained most readily. Sawdust near mills, muck from the low meadows, and loam or sand from the fields will each be preferred by different farmers, according to the circumstances surrounding them. In those sections of the country where grain raising is carried on as a leading business, the straw is used as an absorbent quite freely by the best of farmers. We have seen it spread over cattle yards to the depth of a foot or more in some sections of Vermont and Canada, and such practice is highly commendable where straw is abundant, but in dairy districts the farmer often finds it far more profitable to use his grain straw for feeding purposes. Muck from the swamp makes an excellent absorbent for the stables, hog pens, and cattle yards, but it should be dug out and exposed to the action of the weather at least a year before being used. Wet muck fresh from the swamp is no absorbent at all, and some kinds may be really injurious to the land if applied in the crude state as it comes fresh from the bogs. Any farm soil, if tolerably free from stones, will make a good absorbent for the stable and barn yards.

If one has waste land that he does not care to cultivate, or if he has more than he can properly use by the ordinary methods, it may not be a bad plan to set apart a small area in some out-of-the-way corner, to draw from for this purpose. Plow the ground to kill vegetation and make it easy to shovel, then cultivate occasionally to dry the surface, when the top may be drawn as wanted, or a large pile may be stored for use in wet weather. Some years ago we built a shed adjoining the cattle stables, for the express purpose of laying up dry soil or other material to be used as bedding and absorbent under the cattle, and although we find a pile of dirt a little hard on the wood work of the building, yet we are convinced that no investment we have ever made has paid a better per cent. on the outlay. All the year through, from January to December, there is dry material at hand for taking up all the urine from the animals, much of which would be entirely lost under ordinary methods. We know the practice makes some extra work, but it is work that pays. It will not do for farmers to spend their hard earned dollars for purchasing fertilizers and freighting them miles across the country, while the liquids from their stables are soaking down into the soil beneath, or being washed by every rain into the street, or down some ravine, as is far too often the case. These hot, sunny days are just the time for preparing dry material for the stables, and one should only need to be reminded of it to set about the work in good earnest.—*New England Farmer.*

ADULTERATED MANURES AND CATTLE FOODS.

DR. VOELCKER'S quarterly report to the Council of the Royal Agricultural Society shows that adulterated manures and cattle foods, still find guilty vendors and innocent careless purchasers. A sample of manure sent to the Society's analyst from the neighbourhood of Croydon was found to contain only two per cent. of phosphate of lime, one per cent. of nitrate of soda, and scarcely one-half per cent. of ammonia. The rest of the constituents, such as carbonate of lime, oxide of iron, alumina, and sand, had no intrinsic fertilizing value, and the manure was "scarcely concentrated enough to repay the cost of carriage to any considerable distance." This worthless compound was called "Blood Manure," and sold at £7 per ton. A sample of nitrate of soda sent from Shropshire contained 23 per cent. of common salt. There appears, however, to be some reason to believe that the sample was not properly taken from the bag in this case. A sample of nitrate of soda, sent by Mr. J. L. Baker, Hargrave, near Kimbolton, is however supposed to have been properly taken. The nitrate was purchased at Liverpool at £13 per ton. It was found to contain 35 per cent. of common salt, and only 60 per cent. of pure nitrate of soda. Dr. Voelcker remarks that in comparison with good nitrate of soda, guaranteed to contain 95 per cent. of pure nitrate of soda, and selling at £13 a ton, the sample sent by Mr. Baker was worth only £8-4-2 per ton. A member of the Society sent two samples of compound manures, one made by himself and another a purchased manure, sold at £13 cash. The home-made mixture was really worth 19s. more per ton than the more expensive purchased compound manure, although the manure produced on the farm only cost £9-3-10, leaving a very wide margin in its favour for the expense and trouble of compounding it at home. The member referred to, writing to Dr. Voelcker, very fairly says:—"I have no wish to interfere with respectable manure merchants, and such, I am pleased to say, I have had no difficulty in finding. If manure dealers as a class were led to know that those dealing with them had knowledge enough not to be imposed upon, such impositions as charging from £2 to £5 per ton over the true value of manure would soon be put an end to, and those of respectability would then, as now, be pleased to deal for cash even at small profits." Again two samples of Black Sea rape cake, warranted to be pure rape, on analysis were found to consist not only of crushed rape seed, but mainly of the dirt and small weed seeds which are sifted out of oily seeds in cleaning them for the market. The cakes sent for analysis contained nearly 10 per cent. of sand, and less nitrogen than good and genuine manure rape cake. Dr. Voelcker directs attention to these cases chiefly because the application to the land of such rape cakes may do much mischief in sowing a plentiful crop of weeds, unless special care be taken to destroy the germinating power of the numerous small weed seeds of which the bulk of these cakes consists. The lesson from all these facts supplied in the report of the Chemical Committee of the Society is the advisability of always purchasing according to a guaranteed analysis or warrantly, and when there is any doubt as to the honesty of the dealer or the genuineness of the article, to lose no time in communicating with a competent analytical authority.—*Planters' Gazette.*

COTTON CULTURE IN CYPRUS.

THE cotton of Cyprus belongs to the species called "grassy cotton," (*Gossypium herbaceum*). There is also some "Nakeen," but very little, and it is of a chamois colour (*Gossypium hirsutum*), while lately there has been introduced from Egypt the "Bamina" cotton, which thrives very well in the island. Cotton is sown in alluvial soils, no matter whether they be inundated or not, although in the latter case it is, of course, necessary to water the soil. In the lands inundated by streams it is sown without previously manuring the soil, and in other lands manure is used, though in small quantities, and its effect is supposed to last four years. In a few places a kind of plant is used which lasts 10 years. It begins to yield a regular crop in the third year. No other things are sown with cotton. It is generally grown each consecutive year in the "Livadia," where during the winter the only plant that grows is the yellow clover. The ground is generally prepared for sowing at the end of March, which is done by thrice ploughing the land as deeply as practicable in furrows drawn at right angles to one another, and as closely as possible in order to break and pulverise the soil better. Three methods are adopted for sowing cotton, in each case from the last week in April to the middle of June.

The first method.—This is used only for lands which are inundated, and consists in making deep furrows, 1ft. 3in. broad, by the double, board or winged plough. In order to obtain that breadth and depth, it is necessary to press heavily on the plough, and to pass it over and over again in the furrow. Six women generally follow the plough, and make holes in the centre of the furrow one foot apart. In each hole they place from ten or twelve grains of seed. The seed is very often prepared by steeping it in water mixed with sheep dung. The holes are afterwards filled up with earth taken from them, and pressed lightly with the fist. When this is done, fine soil is scattered over for protection from the action of the sun. This manner of sowing cotton is called "sowing in furrow." After five or eight days the plants appear, and one month after they are thinned, leaving four or five of the healthiest plants in each hole, and the ground is weeded. This method is adopted when the overflow of water takes place, during the months of January and February.

Second method.—When the soil has been prepared as in the first method, and inundated between April and May, seven or eight days are allowed to elapse to let the earth dry, and it is then ploughed with the usual plough; the women, as in the first method, follow the plough, making holes in the furrows, and putting the seed in each hole. When this has been done, they cover the seeds, without pressing the soil. Some farmers put seed in every furrow, others only in each alternate furrow. After the seed has been thus sown, the "Tavola" (harrow) is dragged over the ground to impress and level it. A month after, the plants are thinned, and the ground weeded as described in the first method. This second method is called "Pigliation."

Third method.—The land which is not inundated, but only irrigated, is first manured, and then ploughed, in the usual manner, three or four times, at intervals of 10 or 15 days. The quantity of manure employed per scala cannot be positively stated, but it never exceeds 120 loads (20,160lb.) When ploughing and manuring are completed, a plot of land about 20 paces in width, from the whole length of the field, is watered, during which a man breaks the clumps of soil. The same operation is again gone through in the adjoining plot of ground. After seven or eight days, the "Tavola" is drawn over the soil, and a plot of land, 15 paces in width, is each time sown. The sowing is done by

scattering the seed with the hand, or broadcast, allowing at most 30 oke, equal to 84lb. of seed per scala. After this the soil is once more ploughed, and the "Tavola" passed over it, on two successive days. After six or eight days the plant appears, and 10 days after the land is prepared for irrigation. The land is irrigated every 12 or 15 days. This method is called cultivation of cotton by the watering process; and the cotton obtained by this mode of cultivation has a longer fibre. If rain falls abundantly before the plant springs up, its growth is retarded by the hardening of the soil; and in such case the soil is broken with the spades or with the "Tavola," furnished with rigid branches; an operation which is done under all the methods before mentioned of raising cotton. The cotton produced by the first and second method is called "Anedron," that is, not watered.

In all cases, when the cotton is ripe, which is generally about the 25th of September, asses and horses are allowed to grase in the fields, the opening of the pods being thereby accelerated; they take the leaves, without touching the pods. At the end of September, or the beginning of October, the crop is gathered in, either by collecting the pods, or by picking the pappus from them. When the crop is got in, goats are allowed to grass in the fields. Cotton is picked by women, one woman being considered able to pick, in one day, 20 okes of pods. Cotton is then cleared of the seed by a gin, similar to ours, worked by hand: but this system is rapidly dying out in Cyprus, where steam-engines are being introduced.

The districts where cotton is most grown, are first, the Messorea, on the plains of Morpho and Nicosia; and, next, the districts of Larnaka, Buffo, Famagusta, and Karpas. The better-class of cotton, however, comes from the district of Lefka and Kythrea. In ordinary years Cyprus exports 3,000 bales of cotton, equal to 6,964 cwt. a very small quantity indeed in comparison to what might be produced in the island.—*Society of Arts Journal.*

BEE-KEEPING IN CHINA.

IN many Chinese gardens it is customary to find apiaries; and it may be observed that in the practical management of bees this people are not one whit behind accomplished disciples of the illustrious Huber. They are aware, as judicious bee-masters, that the principal requisites for an apiary are a sufficient protection from the heat of summer as well as from the cold of winter, and a situation far removed from noise. To screen their hives from north and north-west winds, and shelter them from the rays of the sun, they place them under covered path ways, or under the broad eaves of their dwelling-houses; or, if these are not convenient, under the eaves of garden walls with a southern aspect. By adopting the plan of placing the hive close to their dwelling-houses, they make their bees so tame that the approach of a person to the hives does not excite their anger as in England. That the bees may not mistake their respective hives, they do not crowd these together, but arrange them at a distance of twelve to fourteen feet from each other. As water is very necessary to the successful operations of bees in spring and summer, they place their apiaries on the banks of rivulets or near streams of water. Rattan canes or bamboo rods are the materials of which the hives are made, the structure being sometimes covered with mud and sometimes with cow dung, which has been previously well mixed with a gum which freely exudes from a tree called koo-shu. A hive of these materials possess this advantage over the ordinary straw hives of England, that mice cannot build their nests in it, and eventually penetrate unseen into the interior. To each end of the hive a movable circular door is attached. These doors are perforated, the holes being just large enough to admit the bees. By this arrangement, all larger insects which are enemies to bees, are of course unable to enter. Every morning the walls of the hives are carefully brushed to remove dust and prevent the formation of cobwebs. In the spring of the year, when quantities of young are reared, should their be a deficiency of food, the bee-masters are very diligent in supplying the bees with honey. Nor are less care and skill displayed in their management at swarming time. Should the bees upon leaving the hives ascend high in the air, and seem disposed to fly away, the bee-masters endeavour to bring them down by throwing fine mould amongst them. Occasionally I have seen grains of rice thrown with great success among high-soaring bees. A swarm which alights upon a low shrub or tree is swept into the hive by a feather brush, or driven into it by the smoke ascending from a quantity of paper, which is set on fire at the foot of the tree. The swarming season terminates in June, and in the eighth month of the year, what the Chinese call the black or "minister bees" die in great numbers. The Chinese think that were they not to die there would be a great dearth of food for the survivors. It is generally during the night that the hives are deprived of their honey. The bees are driven out by means of smoke. A man with a thin knife then cuts out the comb, and when this has been done, the bees are permitted to return to the hive. Before cutting the comb, the bee-master refers to the calendar to ascertain whether the day which he has selected for the purpose be a propitious one. The comb is put into a muslin bag, through which the pure honey gradually filters into a vessel placed for its reception. The wax is put into a bag made of cotton cloth, the mouth of which is tightly tied; the bag with its contents is then placed in a vessel of boiling water, and the pure material oozes through and floats on the surface. It is then skimmed off and stored in an earthenware jar. During the winter months, when there is a scarcity of flowers, the bees are well supplied with sugar.—*China*, by J. H. Gray, M.A., Archdeacon of Hong-Kong.

THE PROCESS OF FERTILISATION.

By the Rev. J. E. Tenison-Woods, F.G.S., F.L.S., &c.

IT is now many years since Charles Darwin announced to the world, the results of his experiments on the little wayside primrose. This forms an era in the science of botany. Up to that time it was generally believed that each flower fertilised itself. Now it is believed that this is the exception rather than the rule. The consequences derived from this little fact are innumerable. A new school of vegetable philosophy has arisen from it. It has opened up such a field of observation and experimental research, with a harvest of results, all of absorbing interest, that is wonderful to contemplate. Some of our most eminent naturalists have already gathered such laurels upon this field that they are placed upon the pinnacle of scientific fame, and does it not seem strange that all this should have ensued from watching a common wild flower—one that so many eminent men must have seen, and where upon one would think every observation of value must have been exhausted long ago. But the truth is, science has done no more than scratch the surface as yet. Talk of gleaning in such a field? Why the harvest has not begun. I lay stress upon this, because I want to impress upon my readers how much is to be effected in the same field by any one who will use his eyes with care and patience, and at the same time exercise his judgment. It is my main object in writing on this subject, to show how every one who will interest himself in the commonest object by the wayside may render great service to science, and even make brilliant discoveries. If this be true in Europe, where the observers are so many and the field so well worked, how much more so in Australia, where the observers are few or none, and the field quite untrodden. But it is no use saying this, unless how it is to be done is pointed out. Let us take a ripened cone of the common honeysuckle (Banksia marginata), which grows abundantly enough in some parts of Victoria. I am sure most persons must have noticed how few ripened seeds each cone possesses. Sometimes no more than three or four have the thickened, hard, woody projecting valves, which show there is a ripe seed inside. If you now take a flowering cone, and observe the number of flowers—for it would be almost impossible to count them—you may well wonder that so few seeds result. According to theory, each flower has had the necessary material to produce fertility. There are anthers with pollen and a stigma with an ovary, containing ovules waiting to be fertilised. Why are they sterile? Eminent botanists at the present day tell you that they are sterile for want of cross fertilisation, and they point to many facts to confirm this, which I shall try to explain. Observers will notice on the half-opened Banksia flower a number of yellow wiry-looking loops. What are these? The imprisoned styles. But how do they come to be imprisoned, or held in this bent position? In answering this question I must say something about the natural order—the Proteaceæ—to which these trees belong. The flowers in this order are rather an exception to the ordinary plan of flowers. Instead of having a distinct calyx and corolla, these two portions are united to form a tube which is called the perianth. This tube is closed at the end, and when it does open, it splits into four segments. Some times it commences to open from the top, and the segments, or laminæ as they are called, *roll* back, forming curls around the flower, which those who are acquainted with the common Hakea will easily remember. But in many cases the tube does not open till very late, or not at all at the end, but splits along the side. In that case the point of the style is held imprisoned while it continues to grow, and so projects out of the side between the split laminæ in the form of a loop. But there is another thing to be remarked about Banksia. The anthers in this genus (and indeed in the majority of Proteaceæ) are sessile. If you turn back the point of one of the concave segments you will see the anther lying in a little hollow just near the tip. You may require a hand lens to see it well, and then you will notice that it is formed of two cells connected by a rather thick membrane which projects beyond them. The anther cells are long and narrow. The style is also long and narrow, and with the assistance of a lens, it will be seen that just near the end it is thickened, and then tapers away into a many-sided point. Now, according to notions which were very current until Darwin's time, it would be thought that every provision had been made by Nature in this plant to secure the fertilisation of the ovules. For here, you see, the style is held imprisoned right up against the anthers in the point of the flowers. The anther-cells open and discharge their pollen, and the style will generally be found dusted with it. When at last the segments open at the top, the style springs out with elastic force, scattering away the pollen which had collected on it, and henceforth being far out of reach of the pollen from any of the flowers. You would certainly think that if the stigma were not impregnated before it sprung forth, it never would be afterwards. But not so, say the botanists of the present day. They urge that, as a matter of fact, the stigmatic surface is extremely small. It is only a very fine point at the end of the style. It is necessary that pollen should adhere to this point when the stigmatic surface is mature; but they affirm that it is not mature and is not capable of absorbing pollen until it has escaped from the tip of the flower, where it is held tightly clasped. Sometimes, it never does escape, and the style remains as a loop long after the flower has withered. In this case they say no seeds ripen.

Are all these assumptions proved? I think not, and if there were ever a field of observation where young Australian botanists may distinguish themselves, this is one. Let it be remarked that no one seems to question that pollen is needed on the stigmatic surface, in order to obtain fertile

seeds. It would be well to establish satisfactorily that this is the case. It is extremely probable that it is so, but not certain. We have seen that there is an exception in one Australian plant, and there may be others. At least it should not be taken for granted. Next it should be borne in mind that the most of the observations that have been made by botanists in Europe have been made on dried specimens, so the results must not be regarded as either conclusive or satisfactorily. The late Dr. Graham, of Edinburgh, made some valuable observations on the Proteaceous plant Conospermum taxifolium in a living state, and I think Mr. Bentham's remarks on Banksia were made on a living flower. But even so, the facts ascertained are few in number. The flowers in the order examined by Mr. Bentham and others, are Petrophila longifolia, persoonia articulata, P. saccata, Banksia marginata,* Grevillea buxifolia, G. Wilsoni, G. vestita, Adenathos obovata, Agastachys odorata, Conospermum taxifolium, Synaphea dilatata. The only one of these which occurs in Victoria is marked with an asterisk. But there are allied species everywhere in the colony, and as no observations are recorded about them, it would seem that Victoria is quite an untrodden field.

But if the flowers are not self-fertilising, how is the process effected First of all there is just a possibility that pollen does not reach the stigma at all, though this is a view that botanists do not entertain. Secondly, it is supposed that pollen is carried by the wind, by falling from other flowers by birds, or by insects. As to the wind, though this agency may seem unlikely, yet it is a most important one, as the following fact will show :—On April 17, 1850, yellow rain fell in many places in Glamorganshire, leaving spots like ochre. The weather was fine. The roofs of houses, persons out of doors, and the trees were sprinkled over with spots of the above colour. In spite of heavy rain, this dust was still visible for more than a month. It consisted almost entirely of the yellow pollen of a species of willow tree. Again, I have found while riding through the bush when the wattle (Acacia dealbata) was in flower that the clothes, and specially the feathery tissue of a silk hat, collected grains of the pollen, which must have been floating through the air.

As for the action of birds, every one knows how the honeysuckle is visited by different birds, who suck the honey from the nectary. In doing this they must become covered with pollen, and of course must transfer it from one flower to another. As for insects, the flowering cones of Banksias swarm with ants of various sizes and species, besides other creeping things with a taste for sweets. So there would be no difficulty as to the transfer of pollen from one flower to another, if that be necessary for the fertilisation of seed.

There are two things which have principally occupied the attention of botanists in their observations on this subject. One is the contrivance by which the stigmas were secured from being self-fertilised. In Persoonia saccata the stigmatic surface is very small ; it is carefully turned away from the anthers and applied close to the side of the flower, so that pollen cannot reach it. To use the words of Mr. Bentham, the style is short and thick, and only just reaches the base of the anthers. But in order to escape all chance of contamination from them it curves round, turns its back upon them, and buries its small stigma in safety in a protuberance or pouch prepared for it near the base of the tube, from which it is only released by the fall of the segments with their then empty anthers. As a further security in some species, the anther immediately over the pouch in which the stigma is buried, is almost or quite without pollen. There are seven species of Persoonia known in Victoria, in all of which, observations on this singular and interesting feature could be easily made. At present their mode of flowering—or, rather, fertilisation—is unknown.

In the majority of the curved flowered Grevilleas and Hakeas the collecting end of the style is a broad thick disc, with a very thick stigma in the centre. It is supposed that the disc is of use in splitting open the segments of the perianth. In some species the stigma is enclosed in a slit at the end of the style, and this does not open until it has become free from the perianth, and is out of the reach of the anthers. In some Grevilleas there is an appendage at the back of the style, and this is doubled back and pressed close on itself in the bud, acting as a spring to force open the flower. Its use otherwise is not understood, and here, again, observation is much needed.

All the species of Proteaceæ have a structure in their flowers which is replete with the highest interest whenever they are studied. Thus in Conospermum (of which there are probably two species in Victoria) the flower is a straight tube which splits into two lips. The upper is very broad and concave. This has two perfect cells of a pollen-bearing anther enclosed in it. In the lower lip there are three anthers. One is barren, the other two have the inner cell barren at each side. The outer cells have pollen. The style has lengthened far beyond the stamens even in the bud. It has a lateral stigma, and this is directed towards the anthers, the fertile anthers. But these are closed. They are shaped like little cups open on one side, and the pollen as it matures would fall upon the style were it not that the cups of the two central cells are exactly fitted on to the cups of the two lateral ones, which are alone fertile, leaving the three barren cells together on the other side, so that no pollen escapes. As the flower opens the cells open too, but as they do so, the style is elastically bent back, presenting its stigma to the side of the barren anthers, and is far out of reach of the pollen. A structure of equal interest is observed in the genus Synaphea, but as the plants do not occur out of Western Australia it would, perhaps, be useless to specify them.

I do not suppose that many of my readers would be so skilled in microscopy as to be able to discover by careful sections whether the styles of the withered flowers contained pollen tubes or not. The problem to be solved is this :—Given a flower whose ovary is maturing a fully-developed seed, to ascertain whether the stigma has been fertilised by pollen tubes. If it has the style ought to have traces of these tubes. A perfect familiarity with the microscopic appearance of the unfertilised style would first be necessary, and that, one would think, could be easily obtained with a little industry in observing. The subsequent parts of the problem would require great care and great delicacy of manipulation with, above all, conscientious fidelity in recording facts just as they are seen and not jumping at conclusions. With all these qualities united there are as great discoveries to be made by an Australian student as any which have raised scientific men to eminence and renown.

The only Banksia which I have been able to study is Banksia ericifolia. This is a honeysuckle which is known only in a limited area on the east coast, extending a few hundred miles north of Sydney, but not into Queensland, or on the west side of the dividing range. It is very different from any Victorian species, for the leaves are almost minute, while the cones are nearly a foot long. Being of a rose-red colour shot with gold or orange, they are very handsome. I suppose that there must be between 700 and 800 flowers on each wire. The leaves are scarcely more than half an inch long and barely a line in width, lying along the small branches, just like a heath. The style of the flower is about an inch and a quarter long—a rich red in the middle and yellow at each end. The stigmatic surface is an ovate knob at the tip ; it exactly fits into the ovate end—or limb, as it is called—where the anthers are collected. Before the style is liberated it far out-grows the tube, and projects as a conspicuous loop. In every case when it is set free, it is covered with pollen, which adheres tenaciously to it, and this pollen does not fall off until the style commences to wither. As far I could observe it does not receive the pollen of any other flower except its own. Moreover, on carefully dividing the limb so as to liberate the stigma before it could possibly receive any other pollen, I found, on microscopic examination, that pollen tubes were partially formed for some distance below the stigmatic surface. I wish, however, to add that I only advance this statement with the reserve that I am not satisfied, or rather shall not be satisfied on the subject, until my observations are much more numerous, and have been made in a variety of other ways. So far as I have gone, however, I am disposed to think that the flowers of Banksia ericifolia are self-fertilising. I am not able to say as yet whether it is a prolific seed-bearer or whether it be liable to vary. Perhaps other observers can follow out this line of inquiry.

In conclusion, it may be remarked that our common honeysuckle, Banksia marginata, is a very variable form. There are three common species, which are probably only varieties of one. Banksia marginata, with entire leaves one or two inches long, reticulate underneath, with few or no transvers veins ; B. integrifolia, with entire leaves, three to six inches long, with reticulations and transverse veins of equal size ; B. dentata, with broad, coarsely-toothed leaves four to eight inches long, transverse prominent veins underneath. A great number of other varieties have been noted, which all graduate into one another. There are 46 species enumerated for all Australia, but of these only ten are found outside the colony of Western Australia, and these ten may be hereafter reduced to six or seven.—*Australasian.*

GYPSUM.

THE *Field* has the following remarks on the use of gypsum as a fertiliser and deodoriser, which may commend themselves to those interested in agriculture :—

We have recently been informed by an American of great general agricultural experience that, from the time he was a boy till he left America a few years since, he heard the praises of gypsum for agricultural and horticultural crops frequently repeated, and saw the way in which it was obtained, prepared, and applied. At the time of his first experience, the raw material was obtained from France ; whence it was brought to New York as ballast in trading vessels. It was then bought up by millers, and taken in barges up the Hudson and other rivers, and by railways and canals into the Eastern and Middle States. So general had the use of gypsum then become that nearly all the corn millers had a pair of stones fixed in a small out-house for the purpose of grinding it. But at Troy one hundred and fifty miles up the Hudson up to which town this river is tidal, there was a large mill erected expressly for grinding gypsum for agricultural purposes. The application of gypsum was principally to Indian corn and potatoes, but it was frequently applied to cereals and other crops. In using it for Indian corn and potatoes, a man followed the planters with a hod of gypsum, and before the seeds of the former and the sets of the latter were covered he dropped as large a pinch into the dibble-holes as he could hold between two fingures and his thumb. The same quantity was applied a second time just before the potatoes and corn were moulded or "hill'd" up. A part of this practice too, was to dash the fresh cut sets of potatoes with a view to drying them, and to prevent grub and disease from attacking them ; while the corn was soaked through the night previous to its being sown, and when quite wet, stirred among as much gypsum as would adhere to it.

Gypsum as a fertiliser is not unknown in this country ; but its value, either as a deodoriser and fixer of ammonia, or as inoragnic food for plants

does not appear to be duly appreciated. We seldom hear it mentioned by practical farmers. Even in English books on agricultural chemistry it has generally been dismissed in a few words. In Professor Johnson's *Catechism of Agricultural Chemistry and Geology*, it is simply said :—

"Gypsum is a white, solid substance, composed of sulphuric acid and calcium. It forms an excellent top-dressing upon many soils, for red clover and for the pea and bean crops; and is useful for strewing on the moist floors of stables", for the purpose of fixing the ammonia produced during fermentation.

The deodorising properties of gypsum are of the most importance as fertilising elements are thus fixed and held in combination till they are placed within reach of the roots of plants instead of being scattered by the winds. The loss of ammonia in stables, cow-houses, and piggeries, under ordinary management, is very large. The value of guano depends mainly on the percentage of ammonia it contains. Thus while hundred-weights of ammonia are lost in many homesteads yearly, Peruvian guano is bought at £13 to £14 per ton, to increase the growth of green crops and cereals. Even were urine from stables and cow-sheds is caught and applied as liquid manure, it ferments in the tank and much of its ammonical value is thereby lost. There is no doubt whatever, that the use of gypsum for throwing down to absorb urine and hold its ammonical elements in the combination termed sulphate of ammonia, will doubly repay the cost of the gypsum, to say nothing here of the fertilising elements of the gypsum itself. By using a few tons annually, according to the number of animals kept, a heap of valuable manure may be secured for drilling or broadcasting, as the occasion may require.

Gypsum as a fertiliser of itself, is a valuable inorganic deposit of Nature. Next to phosphorus, nothing is so important in vegetable and animal economy as sulphur. It is almost superfluous to repeat that gypsum, is a combination of sulphur and lime. Lime exists in chalk and other calcareous substances, but calcareous deposits without the sulphur, are comparatively of little value The carbonic acid which exists in combination with lime in the form of chalk, is valuable in the soil as a solvent of inorganic elements, and it acts also as nutrition to plants in the form of carbon, when taken up by their roots. But the sulphur of sulphate of lime supplies the elements of muscle and bone in animal life, after it has been taken up and assimilated by plants to which it has been applied. Plants so fed, produce animals with an adequate applied proportion of bone and muscle. It is a remarkable order of nature, that as plants are fed into vigorous and healthy growth, so are they nutritious as food for the animal for which they are adapted. Plants as swedes or other green crops, that are grown on fen land or other black soils, that may be devoid of suitable inorganic elements; will produce animals that are deficient in bone and muscle, or lean as it is commonly termed. In all this there is evidence of the wonderful designs of Nature both in regard to plants flourishing in soil and animals being developed on plants, and in the room there is for man to exercise his talents on the development of both domesticated plants and animals. Gypsum from this point of view is a marvellous deposit for scientific utilisation. Then take the health of domesticated animals in the confinement to which they are frequently subjected. They are often exposed to the exhalations of their own excreta. Tame rabbits that are confined in a hutch, and taste exactly like the scent of the hutch, are only an example. Rabbits, however, seem to be almost proof against disease from their own excreta. But fowl, cattle, sheep, and pigs are not. More than half the diseases in domesticated animals are due to sanitary neglect. We do not say that ordinary exhalations from excreta would produce specific diseases such as "gapes" in fowls "hone" in sheep, foot-and-mouth or pleuro-pneumonia in cattle, and typhoid fever in pigs ; but no reasonable observer will doubt, that animals are as much predisposed to disease by sanitary neglect as an army is to camp fever, where sanitary regulations are not enforced and deodorants are not employed.

AGRICULTURE AND HORTICULTURE SOCIETIES.

THE Government of India have issued the following resolution :—

"Since the issue of the Resolution of the 18th December 1873, the grants to the Agriculture and Horticulture Societies of the Punjab, the Central Provinces, and British Burmah, have been transferred to Provincial Services, and the grant to the Madras Society is likely also shortly to be provincialised. The Government of India will, therefore, leave the question of continuing the grants to the several local Governments and Administrations concerned. The Government of Madras can deal with the proposal for increasing the contribution to the Madras Society, when the negotiations now pending for the fuller development of the Provincial system of finance in the Madras Presidency shall have been concluded. Whether the aid afforded by Government to such societies be from Provincial or Imperial Revenues, it appears to be desirable that such aid should be given on fixed principles ; and the adoption of the following rules is accordingly suggested. The Government grant-in-aid should have reference, *first*, as is practically asserted in the Resolution of 1873, to the work actually done by the Society, and *secondly*, to the amount of income, derived by it from private and local, as distinguished from provincial sources.

As regards the first condition, a provincial grant-in-aid should be allowed or continued where the gardens fulfil public objects which may be thus described :—

I. The introduction and distribution of trees, plants, staples, and vegetables of known economic value, and either wholly exotic or not indigenous in the locality.

II. The experimental cultivation of indigenous products under such varied conditions of soil, manure, irrigation, and culture generally as will test the relative cost and success of different methods.

III. The conduct of other agricultural experiments, as in implements new to the country, or improved descriptions of well-gear and the like

IV. The formation of botanical collections.

V. The diffusion of information relating to botany or agriculture.

These objects appear to have been kept steadily in view by the Madras and Punjab Societies. The good work which has already been done by them, and which they are still doing, as evidenced in the reports submitted, is recognised by the Government of India. For the second condition the Governor-General in Council thinks, that the Provincial grant-in-aid might be fixed at one-half of the total income of the Society from other sources, exclusive of such grant, but inclusive of contributions from District and Municipal Funds. The grant-in-aid would then stand at one-third of the total income of the Society, including the provincial grant In Madras, the Punjab, the Central Provinces, and British Burmah, it is observed that the incomes of the Societies are thus derived :—

Province.	Government Grant.	Grants from Local and Municipal Funds.	Subscription of Members.	Sales of Produce and Miscellaneous.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.
Madras ...	3,500	...	2,578	5,690	11,768
Punjab ...	9,000	5,910	1,122	6,005	22,037
C. Provinces ...	1,200	3,300	896	2,027	7,833
B. Burmah ...	1,200	1,200	1,515	1,140	5,055

In the Central Provinces and British Burmah, one-third of the total income of the Societies there established, would be Rs. 2,611 and Rs. 1,685, respectively, whereas the grants-in-aid are in each case, less than these amounts ; but as the Chief Commissioners of those provinces, do not consider that the primary aim of such Societies has been more than indifferently accomplished, they will probably think it undesirable to increase the allotments, until the objects set forth in paragraph 4 are more adequately fulfilled. The case, however, of the garden at Rangoon, which the Government of India believe to be a useful institution, deserves special consideration. The Chinese are the best gardeners in the Province, and get much help and encouragement in the establishment of their fruit and vegetable gardens from the Society. At present the management is in the hands of an Honorary Secretary who, through keenly interested in the work, can only give to it the leisure he can spare from other public duties. If the Society had sufficient funds to employ a professional Superintendent, its efforts might be attended with greater advantage In the Punjab, one-half of the income of the Society, exclusive of the Government contribution, would be Rs. 6,518. Looking to the good work done, his Honor the Lieutenant-Governor will probably be unwilling to reduce the grant of Rs. 9,000, which is at present made by Government ; but there could be no objection to the understanding that the permanent continuance of this grant would depend on an increase of income from other sources If it were once established that the Government, within reasonable limits, were prepared to give one rupee for every two rupees which the Society could raise, so long as it fulfilled its public objects, the Government of India have no doubt that the effect would in every way be satisfactory. In Madras, the required proportion would very nearly be secured, if the present grant were raised by the amount proposed by the local Government, viz., Rs. 500 per annum. With the above remarks the matter is left for the further consideration of the local Governments and Administrations concerned ; but the Governor-General in Council would wish to be furnished once in every three years with a progress report showing the work accomplished by each society, and the help afforded by provincial funds."

VEGETABLE PRODUCTS IN COORG.

FROM two reports on the vegetable produce of Coorg recently read before the Agri-Horticultural Society of Madras, some idea of the interest attaching to the various crops may be gathered. Rice and coffee are the staple products. The rice crop of last season was looked forward to with great anxiety, and the reporter states that, in the beginning of July last year, when he was on a tour "through the most fertile valleys in Coorg, the paddy fields were dry and none planted, and the ryots lamenting at the long delay of the accustomed monsoon rains ; in the middle of the following month, however, the same district exhibited a most cheering sight ; everywhere the rice fields were clothed with the most luxuriant and brilliant verdure of the newly transplanted seedlings, and rice cultivation carried on even on the highest fields. It is an interesting spectacle to watch the busy hands of a planting party. The seedlings are plucked by women in thickly studded beautifully green nurseries, tied up in bundles, and carried to the edge of the fields, where strong men fling the bundles over the well-ploughed liquid ground. A party of men, arrayed in line take up as much as they can hold in their

left and with their right hand they swiftly and deftly press a few plants into the soft mud, generally in two lines, and as they have their work before them, they are able, guided only by the eye, to plant as straight as by the help of a stretched rope. All the time the rain is pouring, but the men stooping, and halfknee deep in water and mud, are protected with their tortoise-like, bamboo-framed, and leaf covered great coats; the women do not take part in this work, they have afterwards the pleasure of weeding." The second staple product Coorg, namely coffee, had at the period of the above report, been greatly affected by the long continued drought; indeed, there was no estate in the country that had not a tale to tell of the dreaded *Xylotrechus quadrupes*, which, in some places, had taken such hold of the plants as to almost threaten their destruction. Referring to remedies, against this particular coffee plague, the report says, "there is nothing more clearly established, especially in the Bambu district, than the fact that judicious shade, freedom from weeds, and digging or manuring are not only the panacea against the 'Borer'—the infested trees being destroyed wherever recognised—but also the sole condition on which certain and increasing profits may be realised. There are in every district of Coorg coffee plantations which answer the highest expectations of the experienced critic, incite to new hope and encouragement, and prove that prudent and patient energy in coffee planting may still cling to this motto, *Nil desperandum*, and have its reward. It is remarkable how observant the native are of the proceedings of European planters, and how closely they copy to their own profit, whatever commends itself to their judgment as practical and useful. There are estates entirely opened out and managed by natives, especially Coorgs, which are in no way inferior to good European plantations. Land especially in the Bambu district, is still much in demand for coffee cultivation, and sells at high figures.

The various experiments with Liberian coffee do not appear to be encouraging. The plants received from Kew and distributed in small pots by the Mysore Government have not generally done well. Many of them, though transplanted into bamboo baskets and kept in a conservatory, remained sickly, contracted leaf disease, and did not put on a healthy appearance, even after being put into good rich soil.

In a second report on the product of Coorg, dated on the last day of January of the present year, the same report says that the rice crop was harvested during seasonable weather, and that the outturn generally was good, in many instances very good. The abundant *ragi* crop (*elusine coracana*) in Eastern Coorg, and in Mysore, has told on the market very much, bringing again this staff of life of the coolies within their reach, to the exclusion of paddy, upon which they do not thrive. The cardamom jungles produced a very fair crop, and with prices risen, considerable profits were expected to be realized. Referring again to Liberian coffee, the reporter says, "I am glad, on further inquiry, to modify my former report. The plant evidently requires acclimatisation to its new habitation, but when once feeling at home, it makes a vigorous start. As an indication of the rate of growth of this plant in Coorg, it may be said that a tree put out as a seedling in 1875 is now 4 feet 6 inches high. It seems that only one tree is in bearing condition, and this has but a solitary berry. All the trees are slender in proportion to their height."

The growth of cinchonas in Coorg would seem to be satisfactory, for it was expected that some extensive plantations would be formed during the present season. As a substitute for mossing the reporter says he lately observed a peculiar experiment, which to mention, he thinks will be sufficient to deter others from following. The trees being properly barked in strips, the denuded stem was smeared over with clay, &c., tied on with wild cardamom leaves. On removing some clay, the denuded stem was found to be quite dry, for the cambium had fermented, and the formation of bark was consequently hindered, granulation had commenced here and there in irregular lines, but only where the clay did not touch the cambium. The detached leaf stalks of the plantain tree, and the leaves of the wild cardamom or ginger, tied over the wounded stem, will prove an effective substitute for moss, which in Coorg, cannot be obtained in sufficiently large quantities.—*Planters' Gazette.*

VEGETABLE IVORY.

THE plant which bears the seeds known as vegetable ivory is closely allied to the palms, and in appearance and habit it is very like those beautiful trees which are so characteristic of tropical vegetation. The plant is named botanically *Phytelephas macrocarpa*, and it is the principal representative of the *Phytelephasieæ*—a natural order so closely allied to the *Palmæ* that botanists have only recently constituted it a distinct division. Various names have been given to the tree, but the one most generally in use is the Vegetable Ivory Palm. In Columbia and New Granada, where the plant is found in greatest abundance, the natives call it *Marfil Vegetal*.

The tree has a thick, rough, creeping stem, from the under surface of which roots are given off. The leaves, which crown the stem, closely resemble in their size, shape, and disposition, those of the cocoanut palm. The male and female flowers are borne on different trees, the male tree being more erect, and therefore higher than the female. The flowers exhale a powerful perfume, and this is more especially the case with the large white female flowers, which are, however, few in number. The ripe fruit consists of three portions, an external one which is dark, rough, hard, and woody; a middle one, which occurs as an oily pulp of a yellow colour and sweet taste; and an inner portion—the seed—which is the vegetable ivory of commerce. The oily pulp is collected at the right season, and sold under the name of *Pipa de Jagua* in New Granada; and the seeds are exported for use as their name implies, as a substitute for ivory.

The fruits grow from the stem just above the basis of the leaves, and they occur in aggregations of six or seven. The natives of Columbia call these collections of fruits *Jagua* or *Cabeza de Negro*, on account no doubt, of their resemblance in size and shape to a negro's head. Each fruit contains from six to nine seeds, so that in one collection or bunch of fruits there may be as many as sixty seeds, or ivory nuts, as they are commonly but unscientifically called. The seeds have a rough crust, of a dark brown or slate colour, enclosing the white albumen which at one end surrounds the small embryo. The albumen, or the so-called ivory, is of a dull opalescent colour, but it becomes whiter and more opaque by exposure to the light and air. It is softer and less brittle than ivory, and it is therefore, much used as a substitute for the more costly tusk of the elephant, and its use is greatly on the increase. By chemical analysis the "albumen" of the seed has been found to consist of a combination of cellulose, gum, caseine, oil, and albumen, with some residual ash.

The tree was first seen by the Spanish botanists Ruiz and Pavon, in the groves of the hotter parts of the Peruvian Andes, and it was described by them under the name *Phytelephas macrocarpa*. The following extract from the memoranda of these botanists will be read with interest:—"The Indians cover their cottages with the leaves of this most beautiful palm. The fruit at first contains a clear insipid fluid, by which travellers allay their thirst; afterwards this same liquor becomes milky and sweet, and it changes its taste by degrees as it acquires solidity, till at last it is almost as hard as ivory. The liquor contained in the young fruits becomes acid if they are cut from the tree and kept some time. From the kernels the Indians fashion the knobs of walking-sticks, the reels of spindles, and little toys, which are whiter than ivory, and as hard, if they are not put under water; and if they are, they become white and hard again when dried. Bears devour the young fruit with avidity."

The tree, as far as I know, is not cultivated to any extent, the seeds being gathered by the natives from plants in a wild state. Large quantities of vegetable ivory are obtained from the banks of the river Magdalena, and a considerable trade is now being done in ivory nuts.

When a vegetable product is gathered from plants not under cultivation, the supply, from a variety of causes, must of necessity be fluctuating; and the sources of supply are in constant danger of being exhausted, as was the case when cinchona barks were alone obtained from the forests of the Andes. There can be no question, therefore, of the advisability of tropical agriculturists turning their attention to the cultivation of the vegetable ivory plant, as they have already done in the case of the cinchona and other economic trees. The constant increase in consumption of the article points to the success of such an undertaking.

In Jamaica, in Trinidad, and in Dominica, the plant would thrive along the banks of the rivers and streams which run through many of the estates, and thus a profitable crop might be obtained from land which is now principally occupied by a jungle of Roseau reeds. In the Botanic Gardens of Trinidad I recently saw a vegetable ivory tree in full bearing, and I brought a small plant with me to this island. I have written to Central America for fresh seeds; and, should these seeds turn out well, there will be nothing to prevent enterprising planters from adding the name of vegetable ivory to the already increasing list of Dominica exports.—*H. A. Alford Nicholls, M.D., Dominica.*

EXAMINE THE BEES.

BUCKWHEAT seems to be secreting considerable honey this fall in this immediate vicinity, and the chances are that the bees will be in good condition for winter, especially if they are assisted now. Examine all of your colonies closely. The probability is that you will find some of the hives with so much honey in that there is not room for the queen to lay. You can remedy this by changing combs for full ones, or if you are fortunate enough to have some empty combs, exchange some of them for full ones, and by thus equalizing them you will benefit all, for bear in mind, you want to get and keep all of your colonies as strong as possible all the time. The bees that we raise this month are what we will have to depend on in the spring, and now is the time to attend to them. Frost will soon stop all blooming of the flowers and breeding will stop also. Of course those who keep bees in box hives or gums, cannot thus examine the condition of their bees, but must guess at it by their weight, and feed the light ones, or double them up. If you want to raise all of your colonies, it is not too late to build them up by feeding, but this must be done by regular feeding and must not be neglected, although I believe this is poor policy, unless you have but few bees.—*Cor. Ind. Farmer.*

BEE-KEEPING ON THE PRAIRIE.

NO question, says Mrs. E. S. Tupper in the *Bee-Keeper's Magazine*, is more frequently asked of the experienced bee-keeper than this; "Will it pay to have bees on new prairie distant from timber?" Many of the settlers who have come West from timbered and well-cultivated parts of the country, especially from Wisconsin, Ohio, and Western New York, find the condition of things so different, that they are fearful of trying the experiment, and we often hear them say, "I miss my bees; if I thought they would do well, I would have them again, but the winds, the late springs, the absence of fruit, &c., make me fear to try."

Now the facts are that these very conditions are in a better country for bees—one richer in honey-producing plants, and containing more honey by far—than in their old homes.

It is true that bees need different care on the prairie, and gather honey at different seasons, but if the common sense used in other things, and without which bees cannot be managed successfully anywhere, be called into action, they may be made a most important source of wealth in all our prairies.

This is not theory only. Reports come from many prairie bee-keepers of wonderful yields of honey from their hives, and much more

than average success in wintering. New comers to the prairie, finding no fruit blossoms, no white clover, and no linn, jump to the conclusion that there is no honey, without considering that Nature generally equalizes these things, and in withholding some sources abundantly compensates by a bountiful supply of others. From the middle of July until even after frost, the prairies are covered with honey-producing plants. In a ride of a hundred miles in August, last year, there was not a mile where honey-producing plants were not found, and at that season of the year warm days and cool nights cause honey to be secreted in all. In this respect the prairie has great advantage over timbered country, for there the harvest comes at a season, when showery wet weather often interferes both with the secretion and the gathering of the honey, while on the prairies the great harvest comes in the best season of the year. We have known 64 days in succession when bees could work without interruption from the last of June until the middle of September; all the rain for that length of time coming at night, and during that time, asters, golden rod, wild buckwheat, smart weed, and several varieties of purple flowers were abundant on every side.

To manage bees here their supply should be sufficient to support them eight months, from October till June. Most seasons they would gather considerable—enough to encourage broodrearing—in May; but it is not safe to calculate thus, unless you expect to feed. And here let me say that except in California, and perhaps, Australia, in favorable seasons the honey harvest rarely extends four months.

The fear of wind is a bugbear. True the wind blows nowhere else as it does upon the prairie; but the bees no more leave the hives on very windy days than they do in rainy weather. We have known six windy days in succession, warm days, too, when not a bee ventured from the entrance. Sudden winds, like sudden showers of course may sometimes catch stragglers away from home.

If properly managed, colonies will be very strong by the time the harvest begins, and the increase may all have been secured before, so that every hive will be well stocked with honey gatherers, and in nine seasons out of ten profit is certain.

Wintering is no more difficult than in other locations. Protection either in cellars, improved hives, or by burying, is absolutely essential everywhere. The homesteader, who has but few hives and has not provided double-walled ones, and has no cellar, can, with great ease, put a box, or boards, or corn stalks, around each hive, and throw dirt over it. We have seen many colonies winter thus, and there is no better way. The object in protecting being always, to secure an equal temperature.—*Journal of Agriculture.*

WHAT BREED?

AN exchange thus replies to this question :—We are often asked the question by our correspondents, what breeds are the most profitable for them to keep. Now the same difficulty arises in the solution of this question, that comes up with regard to breeds of cattle or sheep. The cows that give the best results in dairy products are not always the best for beef, and the sheep that produce the best wool do not make the best mutton. It is so with hens. If they are wanted for their egg product, one breed may be profitable ; if for poultry for the market, quite another breed would be selected. For poultry, the Brahmas, Plymouth Rocks, Dorkings, and some others of the larger kinds are best, and in our judgment, either of the two first-named breeds answers every good purpose. The chicks are hardy, and with proper care rapidly develop ; they grow large and handsome, are good layers, and on account of the disparity between the weight of their bodies and size of their wings, they are easily kept within bounds, and are thoroughly domestic in their habits. Their eggs are of large size and rich, and though when sold by the dozen according to the present unequal practice, they bring no more than those of the smaller breeds, for home use they are worth from a quarter to a third more. For layers, without reference to their carcass for the market, there is probably nothing better than the Leghorns, and of these there are four varieties, *viz*, black, white, brown, and the Dominique. All of these are distinguished only by their color, in other respects being the same. They are not as hardy as some other kinds, and cannot be recommended to those who are obliged to keep them shut up in small yards, as they are high flyers, and will go over almost anything in the shape of a fence. They are a very handsome, shapely bird, but the hens are non-setters, and some other kinds must be kept to attend to this duty and to the rearing of the brood. A cross with the Brahma or Cochin produces a desirable fowl either for laying or poultry purposes.—*American Paper.*

BOTANIZING IN AFGHANISTAN.

SURGEON-MAJOR J. E. T. AITCHISON, Botanist with the Kurrum Field Force, has sent for the information of Major-General F. S. Roberts, C.B., V.C., Commanding the Kurrum Field Force, the accompanying report upon our present knowledge of the Kurrum and Harriab districts. Dr. Aitchison says:—"I consider it a matter of great importance to science, if Government would consider the subject and permit me to remain employed for some time at these investigations, and hope the Major-General will take the matter under his favourable consideration." The report is as follows :—

Thull—Is a village on the Kurrum river at an altitude of 2,500 feet, surrounded closely by low hills, the highest peak in its vicinity being that of Kadimuk, 4,900 feet.

In the small basin of Thull the flora is peculiarly that of the Salt Range of the Punjab, consisting of few stunted shrubs, with occasional trees near water. The hills are, with the exception of grass, nearly barren of anything like vegetation, and when it does exist, it is in hollows where shade and moisture can be obtained.

Kadimuk would from its altitude, if it were in the Punjab Salt Range, be much better clothed. Here already the crushing out effects of a winter, cold enough to deposit snow, and want of moisture in the atmosphere, point out why between this and the base of the Safed Koh Range there exists little or no natural vegetation.

In summer for several months the climate is that of the Punjab—a dry tropical heat. There are few plants that can withstand these extremes of temperature.

The result is that, as we proceed towards the town of Kurrum (4,800 feet) we find, except such parts of the country as are cultivated by irrigation, that it is treeless and almost a barren waste.

In the basin of Thull, where the Punjab forms are nearly all present the first characteristic one to be absent is *Capparis aphylla.*

The olive is rare ; from this to the village of Shalizan I have only seen it near houses, and holy-places as ziarats, its place being taken by *Reptonia buxifolia,* which bears a remarkable resemblance to the olive.

A little distance out of Thull in the more open country, *Daphne mucronata Royle sophora mollis, Wall.,* and *Contoneaster nummularia, Fisch.,* are the plants that make up most of the scrub jungles, and range from this right through the Kurrum Valley up to the Hariab, all reaching to nearly 10,000 feet, and form what little scrub there occasionally is amongst the pines at this high altitude.

In gradually ascending the Kurrum Valley we soon lose our chief Punjab forms. At Ahmad-de-Sama, 8 miles from Thull, *Acacia modesta* and *Dalbergia sissoo* are last seen.

Periploca aphylla, however, accompanies us to nearly opposite Kurrum, and in some quantity, being largely cut and collected as fodder for camels.

The only occasional tree, except in the immediate vicinity of water is *Pistacia integerrima* and a small *Rhus.*

Wherever water is employed for irrigation there the crops are good, and trees of various sorts rapidly spring up.

At Hazir Pir Ziarat fine trees of *Platanus orientalis* and *Salix* are to be seen ; these increase in number and size as we reach Kurrum.

Up to this *Chamærops Ritchieana* has been more or less frequent, but from this it gradually disappears along the left bank at least of the Kurrum Valley, but is found forming a thick dense aloe-like scrub on the plateaux that lead west up to the Darwaza Gai Pass.

When this palm is not injured or cut, it forms a branching tree of from 15 to 25 feet in height, as may be seen at many of the shrines between Kohat and this, or even within the walls of Peshawar near one of the gateways. It extends largely into the Khost country. In the Kurram Valley the fibre of the leaves is the usual and ordinarily the only source of rope all imported as leaves from Khost.

Kurrum is a large village and fortress situated on the left bank of the river of that name, at an altitude of nearly 4,800 feet, in an open valley. The nearest hills to the north being over nine miles off, to the south some low hills descend close into the river, but speaking generally it is situated in an extensive open plain, the broad bed of the river lying to its south.

At a distance of about 15 miles running from east to west (slightly south) is the Safed Koh range of hills. The two highest points are at the extreme ends. The one at the east called Karaira is about 15,200 feet, the one at the west called Sika Ram (but by the local natives Spin Ghar) is 15,400.

From Kurrum, 4,800 feet, to the base of the hills to its south, up to 6,000 feet, except for irrigation, which has been most laboriously carried out, the plain country would be an arid shrubless tract perfectly treeless ; grasses, and a few small herbs alone give the little green that occasionally meets the eye.

When irrigation is employed, then the crops are in profusion and rich, the soil yielding two crops in the year, the first barley, wheat, and clover ; the second maize, rice, millets, tobacco, peas, cucurbitaceæ, a little opium, and some cotton in the more southern parts of the district, with numerous orchards of large trees.

The greatest extent and finest cultivation occurs at the exit of the various streams from the mountains on to the plains, under the protection of the hills, as for instance at Shalizan, where the trees grow to as great a size of their kind as any in Cashmere, and much more healthy, owing to the dryness of the climate preventing the numerous lichens and fungi affecting the trees. There are *Phuadrs Platanus orientalis* with a girth of 14, 16, 18, 25, and one 33 feet.

The walnuts are finer than any I have ever seen. Many trees of 9, 11, 12, 13, and one of 17 feet. With rare exceptions, are the trunks ever hollow or unsound. They have neither lichens nor mistletoes infesting them as in Cashmere.

The Amlok *Diospyrus Lotus,* is very numerous, a good tree, its fruit is considered next in value to that of the walnut.

Apricots, plums, apples, pears, grapes, *Elæagnus,* a few peaches, quinces, pomegranates and almonds form the mass of the orchards. There are no cherries. Mulberries are grown for feeding silk worms with, and as trees are not extremely numerous, but are fine trees.

In actual gardening the natives do little. Onions, a large white radish, with numerous cucurbitaceæ, are all they go in for.

Cultivated as flowers in gardens, and near holy places are the red Damascene rose, a white one, and the double yellow Persian rose, an iris, a mallow, *Melia Azedarach*, as also an *Elæagnus*, cultivated both for its scented flowers as well as its fruit.

The other cultivated trees are *Populus alba*, *Salix babylonica*, and *Celtis australis L.*, besides another poplar, new to me.

There is one cypress in the valley of great age; it is on the side of a hill close to Shaluzan, and noticeable at a great distance.

On the plains between the Kurrum river and Shaluzan, the little scrub that there is consists of *Daphne*, *Sophora*, *Cotoneaster*, some Barberries, a *Buddleia*, numerous *Astragali*, *Labiatae*, *Compositae*, of which species of *Artemisia* are very numerous; but any or all of them are chiefly found in the more sheltered hollows rather than on the open plain.

Convolvulus lanuginosus is profuse in small hummocks from the Salt Range to Kurram and Ali Kheyl.

Many species of the numerous *Astragali* found here will prove to the Tibetan in their type.

These plains consist of *débris* of all shapes and sizes with mould poured down from the adjacent hills by the force of snow and water deposited in great fan-shaped masses, with a stream belonging to each fan, cutting its way down through its centre and making its way towards the river, usually reaching it with a much diminished supply of water, whether taken from it for irrigation purposes, or absorbed in passing over the loose beds or shingle. In some instances the whole of the water of a stream, especially in summer, is expended long before it has any opportunity of getting to its proper outlet—the River Kurrum.

The general outline of the country, and the above peculiar fan-shaped *débris* deposits are best noticed at some distance from the south, as in crossing over the Darwaza Gai Pass towards Kurrum from which the view very much resembles that scene of the Ladakh Valley on looking southwards from Leh, as long as one can imagine the distant forest to be mere shading of the hills.

In looking over the Kurrum Valley and the hills beyond from the Darwaza Gai Pass, we see lying before us (usually) the great mass of the snow-clad peaks of the Safed Koh range, extending from north-east to south-west.

The lower hills, or rather high peaks of the spurs of the main range, seem to form two or three lower ranges, these are all covered with forest from the top down to 7,000 feet, after which they are seen to be bare as they gradually lose themselves in the plains that extend from 9 to 15 miles before it reaches the river.

The first vegetation to be traced on these hills on their southern exposure is *Quercus Ilex*, commencing at about 7,000 feet, as a good large dense bush; this as it ascends gets more tree-like and begins to be mixed with Deodar, *Pinus excelsa*, *Abies Smithiana*, gradually forming a dense forest when *Abies Webbiana* appears in it, chiefly near the ridges, and continues up to 11,000 feet, when the forests thin off, and gradually it ceases. At 9,000 feet, commonly *Quercus semicarpifolia* appears and takes the place of *Quercus Ilex* if it has come up as far, or often drives out the Pines and forms a forest of its own.

East of Shaluzan with a south exposure there is no *Juniperus excelsa* or *Pinus Gerardiana*, and as far as I can hear, and of what I myself have seen, there is no *Pinus longifolia* from Thull to this. *Pinus excelsa* in this district taking to itself the Pashtu term "Nakhtar."

Except the bushes being larger of the already specified *Daphne Sophora*, *Cotoneaster*, Barberries with an occasional *viburnum* and honeysuckle, there is no undergrowth or bush vegetation.

In this locality these forests of Deodar are very fine, and the timber superb. It forms fully three-fourths of the forest usually. Except of *Quercus semicarpifolia* in certain localities, the timber of the other trees is in too small a quantity to be alluded to when so much Deodar is forthcoming.

It is curious to note how the forest of Pines is directly got at through the *Quercus Ilex* scrub, there being no intervening forest as in the Himalayan ranges.

As already stated, these forests reach up to 11,000 feet, here they become less dense and a few shrubs of *Rhododendron Anthopogon*, the gooseberry and currant with bush juniper (*not excelsa*) and some willows and Loniceras fill up the vacant spaces in the ending forest until the bush juniper alone with *Betula bhojpattra* (in one locality) alone remain to be superseded by Rhubarb, *Eremurus Fritillaria*, some grasses, *Carex*-s and Cruciferæ.

Vegetation here is not stopped by perpetual snow, as on the southern exposure of this range, there was no snow during the winter of 1878-79, but it is kept down I should say in its altitude by want of moisture in the soil as well as air. If snow existed all the year round, vegetation would naturally ascend, I believe, higher than it now does.

From Thull to Shaluzan and up the southern face of these hills I have seen but one fern, *Adiantum Capillus Veneris*.

Heretofore I have gone over the vegetation as presented to us upon the southern aspect of these hills. Let us go along a water-course, or stream bed, and examine any other exposures of these hills than the south.

We find in the first place the pines descending to form a natural forest much lower down, a deodar and *Pinus excelsa* may be seen at 6,500 feet. The forests thin with a great deal of shrub and underwood, and shrubs gradually being removed by other trees than pines.

At first it is enlarged bushes of the original *Daphne Sophora*, *Cotoneaster* Berberries, then *Fothergilla involucrata*, (a Cashmere type), *Cotoneaster bacillaris*, several roses, *Buddleia* in profusion, several large *Astragaloid Leguminosæ* another large Barberry, two Jasmines, several Loniceras, Pomegranate, (wild), all mixing with *Quercus Ilex* as a dense bush, sometime a tree and a profusion of grasses.

In the "Shud Tor" ravine, with entirely precipitous sides and narrow we come upon the walnut as a forest tree quite wild, proved by the fruit, and, perfectly natural, two species of *Euonymus*, *Viburnum*, *Carpinus*, *Prunus Padus*, *Sterculia*, various *Lonicera*, *Rhamnus*, and in the moisture of this valley *Taxus baccata*, this being its western limit, it occurs in all the valleys to the east in similar positions.

At from 8,000 to 9,000 feet a *Rhododendron* near *lepidotum* of Wallich with green flowers.

Besides a *Lycopodium* eleven species of ferns. *Podophyllum* and quantities of *Hedera Helix*.

Neither *Juniperus excelsa* nor *Pinus Gerardiana* exist here.

The Peiwar Kotal range is a spur from Sika Ram (Spin Ghar), extending south-west until it gradually loses itself in numerous small spurs at the Kurrum river round which the Kurrum river bends from a southerly to a south-east direction. The range of hills at the Peiwar Kotal have an altitude of from 8,400 to over 9,000 feet, with a precipitous descent of nearly 1,000 feet to the east.

At the base of the Kotal in the valley leading up to it by the village of Turai, except when cultivated, the ground is covered with a more or less dense jungle of *Quercus Ilex* (covered with two species of mistletoe), but mixed here, as we notice for the first time, as a shrub soon becoming a tree *Juniperus excelsa*, and our old friends the *Daphne*, *Cotoneaster* and *Sophora*, besides more numerously the small yellow rose, and *Buddleia*. As the ascent up the precipitous face of the Kotal takes place, Deodar becomes numerous with the oak as a tree, and *Abies Smithiana* and *Pinus excelsa* now forming a tolerable forest. Here an ash, *Fraxinus Moorcroftiana*, *Wall.*, is not uncommon, and *Juniperus excelsa* as a tree numerous.

But not until we get fairly on and into the woods of the Kotal do we come upon *Abies Webbiana*.

Except the two oaks, *Quercus Ilex* and *semicarpifolia*, there is no undergrowth whatsoever.

Taxus baccata does not exist in the forest, nor do we come upon Gerard's pine until we pass through the forests of Kotal and come upon their north exposure, where, on the lower edge of the forest, it is common.

The Deodar forests from the Spin Ghar Kotal to the Peiwar Kotal, and for miles to the south upon this spur of hills, is simply superb, and almost unlimited in extent, and capable of being easily worked.

The other pines are proportionately few, but help to form a very dense forest.

The Hariab district is the basin of the Hariab river, that is formed by the south-western base of Sika Ram (Spin Ghar), and its two spurs the Peiwar Kotal range running southwards, and the range that ends in Mount Matunge running nearly west. The Hariab falls into the Hazar Darakht river at Ali Kheyl.

The Hazar Darakht river forms the base to the triangle with the two ranges of hills already spoken of, and thus completes the boundaries of the Hariab district.

The Hariab river takes its rise from the several streams that rise from the south-west face of Mount Sika Ram (Spin Ghar); it is supplied by tributaries from the hills to its north and south until it reaches Ali Kheyl, where only the streams from the south and east of Mount Matunge fall into it as it itself joins the Hazar Darakht, a much larger stream. This united stream subsequently flows into the Kurrum.

At Zabr-Dast Killa the river may be called Hariab, as here at about 8,200 feet the river is joined by several streams of one size.

On its southern or left bank, until the river reaches Ali Kheyl, there is little or no cultivation, as the hills come down to the banks of the river. On the right bank there is a great deal of cultivation, as there is a large amount of good land on this side in plateaux, all of which is fairly cultivated from the base of Sika Ram to Ali Kheyl.

The land produces but one crop during the year—wheat, barley, maize, rice, millets, pulses, and clover.

Tobacco is occasionally grown, and several of the cucurbitaceæ; no vegetables, ghlam, or oil-seeds.

The climate is much colder and drier than that of Kurrum, with a more rigorous winter.

The plane tree, *Diospyros*, and vine do not grow here. The walnut as a good-sized tree bearing fruit is rare; small trees are not uncommon. In the stream bed *Salix babylonica* is a large tree, which, with a naturally wild *Salix*, are both cultivated to protect embankments for irrigation purposes.

Hippophaë is cultivated as a hedge, and along with it an *Elæagnus* is common. The chief sources of fruit are apricots, plums, and apples, and a few pears.

The jungle scrub of the hills is chiefly *Juniperus excelsa*, with a very characteristic small stiff spinous grey *Prunus*, very handsome when in full bloom with its peach-like blossom, *Daphne*, *Sophora*, two species of *Cotoneaster*, honeysuckle, *Viburnum*, the single yellow rose, and another with *Cratægus*. In addition to these, as we get somewhat into the forest, currants, gooseberry, a species of *Colutea*, and a very handsome laburnum-like *Astragalus* called, "jirrol:" the bark of this, cut off in rings, is employed in lieu of brass rings to the sheaths of Afghan knives, and not the bark of *Betula Bhojpattra*, the paper birch, also a most superb

great abundant honeysuckle, rose-red colour very fine, and I think a new plant. These forests would grow down to the stream, but they have been driven back by cultivation and search for firewood.

On the southern exposure of the Peiwar Kotal range from two miles to east of Zabt Dast Killa and in all forests lying to the west of Sergul is *Pinus Gerardiana*. The Deodar and *Juniperus excelsa* from the forest from this to Ali Kheyl.

Pinus excelsa, Abies Smithiana, and *Webbiana* are driven out into the higher forests and ridges.

Abies Smithiana and *Pinus excelsa* one can always detect by their cones in the streams, as occurring somewhere above. *Abies Webbiana* has to be gone and looked for.

No *Taxus baccata*, Rhododendron, or *Betula Bhojpatra* exist to the west of Sika Ram at least in the Hariab district.

The fern that is occasionally to be met with is *Asplenium Ruta muraria*, but I have found five others. *Adiantum Capillus Veneris* and *Ceterach officinarum*—both only near Ali Kheyl; *Asplenium trichomanes*; *Asplenium septentrionale*, and another *Asplenium*—only in one locality each.

The forests here extend up to 11,000 feet, but higher on the northern side the hills are not so precipitous, and there is more moisture.

In a practical point of view, the great value to be attached to a botanical examination of the Kurrum and Hariab valleys is its vegetable products, and the value they may possess for any export trade.

The first of these is timber. The Deodar our finest Indian Himalayan timber tree, forms dense forest, many of which it will be found can be easily worked. There is at present no limit to the amount and quality of this timber that can be obtained: means of exportation and forest conservancy are the subjects that now require to be studied.

Deodar timber used to be exported from near the Kurrum river in Mongul territory, by floating down the Kurrum *viâ* Thull to near Bannu. But this has some years been given up.

In grain these valleys have heretofore had no export trade, producing no more grain than was absolutely required for local consumption. I may say the same of their fruits, except perhaps walnuts and amlok (*Diospyros*).

The cause of this is simply *oppression*. There is land enough to double or treble the produce.

With a very little more than ordinary care of the water, as it is expended, one-third more ground could be brought into cultivation; by appliances of a cheap nature, as wooden troughs, one-third more; and more expensive plant would enable it to be doubled.

The very first effects of our rule in this valley will show itself even this season in there being grain enough for our troops locally produced, and next year exportation will begin to take place towards the Punjab for exchange for cotton goods, which are at present expensive.

I cannot come to any opinion as to whether the nuts of Gerard's pine were exported as a real trade article from the Hariab. I know that it is so from Khost.

The natives use no oil; splinters of the roots of Gerard's pine or of the stems of *Pinus excelsa* being used in place of lights.

A crude tar is made from the roots of the above pines for local use. This is their nearest approach to oil. It is employed for local application to wounds and sores.

A little silk is produced at Shalozan and some other villages; but in this there is no trade.

Probably the substance in which most trade is done both on a large scale and barter is honey. This is extensively exported by through-carriers to Cabul and the Khost country. Nearly every house in a village has its bees from Kurrum to Ali Kheyl.

In a scientific point of view the great value of a thorough and careful research in the vegetation of this altogether new to science district, is the material assistance it will give to the better knowledge of the geographical distribution of plants, and the meeting of the several Floras of Europe, Persia, Afghanistan, Tibetan, Himalayan, and Punjab tropical, which I already see radiate round the Sated Koh range as a focus, besides enabling one to obtain a more detailed and extensive knowledge of the peculiarities in the distribution of plants dependent on climatic zones, more or less influenced by a moist or dry atmosphere.

From the 600 species I have already collected, I can see already the immense value likely to accrue to scientific botanists by the collections I am now making, and consider that the Government should permit of the subject being thoroughly worked out.

THE GARDEN.

A PRACTICAL HINT FOR ROSE-GARDENERS.

THE *New South Wales Agriculturist* informs its readers, that soot taken from chimneys up which only the smoke from wood fuel has passed, is peculiarly suitable for the manuring of rose trees, when applied in the proper way, which is thus described by him for the guidance of such as may wish to try the experiment. Having collected the soot from the various places of its deposit, put it into an earthern pitcher and pour boiling water on it; using the mixture every few days to water your rose plants. The effect of this treatment, says the *Agriculturist*, "is wonderful in producing a rapid growth of thrifty shoots, with large thick leaves and a great number of richly tinted roses." This application has also another effect, we believe, which will be found equally beneficial; namely, that of destroying the insect life with which rose bushes are so commonly infested. It is to be hoped that information regarding this matter will find its way into France, where the supperabundance of insect life seems to have lately caused a vast amount of mischief, to rose trees in particular. The May bug or beetle, is the pest there most general and most dreaded; as being more destructive then any other insect foe man has to contend with, except perhaps the phylloxera; this last being generally recognised as the husbandman's worst enemy. To show the serious extent of the mischief impending over rose cultivators in France, it was lately stated at a meeting of the Central Horticultural Society of Paris, by the head gardener of Chantilly, that the *larvæ* of the May bug were fast destroying his roses. One hundred and eighty-seven days' labour had been expended, on the work of clearing about an acre of ground; each man engaged in it disabling 5,000 per diem; the total got rid of being close upon a million. Another member stated that "more than half a million had been collected on every hectare of his estate." It is to be hoped, that those winged plagues will not find their way in force across the Channel, should the winter not extinguish them, as they did long ago, according to old records of their visitation. "A writer in the Philosophical Transactions states, that there fell into the Severn, on February 24, 1574, such a multitude of these insects, that they clogged and stopped the water wheels" of the mills; and the Transactions of the Dublin Society likewise mention, that the country people of some parts of Ireland suffered so severely from the same cause, "that they set fire to wood some miles in length, which parted two adjacent counties, to prevent the insects dispersing themselves any further that way." In fact they would seem to have then been almost as great a plague as locusts now are, in different parts of the world.—*Athenæum.*

FORESTRY.

COLONEL BEDDOME deserves great credit for his perservance in the matter of mahogany seed. He has repeatedly failed, on account of bad seed, and now we learn that out of 34,000 seeds, he has succeeded in raising 12,000 seedlings, and he yet looks for a few more. As the Madras climate seems admirably adapted for the growth of this magnificent timber, we shall watch his experiment with interest.

ON a recent visit to Prince's Park, Liverpool, my attention was attracted by a remarkably fine specimen of *Eucalyptus globulus* growing on a bank with a south-east aspect. The rate of growth appeared to me to be something unusual, as well as the exceedingly symmetrical proportions of the bush and its fine glossy foliage. I was therefore tempted to inquire of Mr. Mason, the courteous curator of the park, something of the history of the plant, and he has kindly furnished me with the following particulars. The height of the plant is 20 feet, its diameter through from tip to tip of branches at 3 feet from the ground 10 feet, or equal to a circumference of 30 feet; girth of stem at 1 foot from the ground 11 inches, and at 4 feet from the ground 9½ inches. The plant has but one main stem, which is perfectly straight and uniform in growth all round, forming a beautiful pyramid. It was planted out in the summer of 1876, a small plant, and grew that season to the height of 18 inches or 2 feet. It stood the winter of 1876-77 uninjured, and started into vigorous growth in the spring of 1877, and made a growth that summer of 12 feet in length, clothed with branches to the ground. The tips or points of a few of the branches were slightly injured last winter, but not sufficiently to spoil the appearance of the tree further than giving it a rather brown appearance. The injured points of the shoots were cut away last spring, and the plant has grown this summer to the dimensions stated above, which (as far as I know) is a rate of growth seldom if ever equalled in England. —*W. Hind in "Gardener's Chronicle."*

FORESTS DIRECTLY INCREASE THE SUPPLY OF WATER IN THEIR NEIGHBOURHOOD.

THE French Foresty Department, according to the *Polybiblion* are satisfying themselves that forests directly increase the supply of water in their neighbourhood. From careful observations at Senlis and Nancy, they have decided that it rains more abundantly in wooded tracts, and that while the leaves and branches give back the water quickly to the air, they prevent rapid evaporation from the ground, and are thus favourable to the formation of springs. The effect of denudation upon the supply of water is a point of extreme importance, and indeed, almost involves the existence of countries like Spain and Hindostan Proper, where the fall of water has perceptibly diminished. The denudation had been carried too far was suspected, but about the method of its effect, there has been endless dispute. The French experiments show that it is direct, and that a treeless plain, such as Castille threatens to become, and the Punjab had become when we conquered it gradually deteriorates into a desert.—*Spectator.*

RECKLESS DESTRUCTION OF FORESTS.

THE *Augsburg Gazette* remarks that ever since the establishment of the Brenner and Farter Valley Railway, the Tyrolese country people seem to have been seized with a mania for cutting down every single tree to which they can possibly gain access, without taking the least precaution to plant new stock in their place, with the exception of a few apple trees here and there in the Botzen and Méran valleys. The natural consequences of this folly are now making themselves felt. Year after year avalanches, downfalls of stones and mud, inundations of over-swollen torrents, are becoming more and more frequent, bringing misery and desolation in their train. Thus the Naif stream causes terrible damage nearly every year, destroying acres upon acres of vineyards and orchards, by carrying down stones and rock upon them in its course. Tempted by the high prices offered by outside dealers, the peasantry of Brixen, Botzen, and Méran have sold thousands and thousands of magnificent walnut trees within the last few years, and now the well-known chestnuts of the Tyrolese mountains are being similarly sacrificed. Even the historical fir at Botzen, which has long served as a landmark for miles around, and was known through the whole country side, has been felled without scruple, in spite of all attempts to save it. These continued denudations are leaving their mark upon the climate. The spring season is now far more severe than formerly, and the spots at one time so much frequented by strangers on account of their mild climate are now but little visited, being no longer sheltered from the keen winds by their natural protection of forests and wood.—*Farmer.*

FORESTS AND METEOROLOGY.

AN important paper in *Polybiblion* on this subject gives the results of observations made during the last six years under trees and not far from the edge of a forest, and also in the plain and far from all trees. 1. Forests increase the quantity of meteoric waters which fall on the ground, and thus favour the growth of springs and of underground waters. 2. In a forest region the ground receives as much, and more water under cover of the trees than the uncovered ground of regions with little or no wood. 3. The cover of the trees of a forest diminishes to a large degree the evaporation of the water received by the ground, and thus contributes to the maintenance of the moisture of the latter and to the regularity of the flow of water-sources. 4. The temperature in a forest is much less unequal than in the open, although on the whole it may be a little lower; but the *minima* are there constantly higher, and the *maxima*, lower than in regions not covered with wood. These observations have been made in the neighbourhood of Nancy, and by the pupils of the School of Forestry of that city, under the direction of M. Mathieu, Sub-Director of the School. On the other hand, M. Fautral, when Sub-Inspector of Forests at Senlis, made during four years, but on a different method, observations on forestal meteorology which fully and completely corroborate in certain respects those of M. Mathieu. The laws which seem to follow from the figures given by M. Fautral, as well as an inspection of the curves which graphically represent them, are as follow:—1. It rains more abundantly, under identical circumstances, over forests than over non-wooded ground, and most abundantly over forests with trees in a green condition. 2. The degree of saturation of the air by moisture is greater above forests than over non-wooded ground, and much greater over masses of *Pinus sylvestris* than over masses of leaved species. 3. The leafage and branches of leaved trees intercept one-third, and those of resinous trees the half of the rain water, which afterwards returns to the atmosphere by evaporation. On the other hand, these same leaves and branches restrain the evaporation of the water which reaches the ground, and that evaporation is nearly four times less under a mass of leafed forest than in the open, and two and one-third times only under a mass of pines. 4. The laws of the change of temperature out of and under wood are similar to those which result from the observations of M. Mathieu. The general conclusion seems to be that forests regulate the function of water, and exercise on the temperature, as on the atmosphere, an effect of "ponderation" and equilibrium.—*Times.*

MINERALOGY.

A COMPANY has been formed at home to work the Punjab Coal, and an Allahabad contemporary tells us that there is *no* coal in the Punjab. We sincerely trust the is wrong, as the Punjab is groaning under a perfect famine of the article. At Lahore it costs over Rs. 30 per ton, which makes dear railway working. It seems rather a strange proceeding, that a company should be termed in England by gentlemen well acquainted with India, to work a material that is said to have no existence in the district, and we would be inclined to attribute to the noble Chairman, a much larger amount of good sense, than such a proceeding would indicate. We trust therefore that our contemporary is in error.

A PRIVATE telegram received at Simla from London intimates the formation of an important committee, with Lord Tweedale as Chairman, for working the Punjab coal mines. No further particulars are known at present.

THE richness of Chota Nagpore in coal is well-known. Five mines in Hazareebaugh, two in Manbhoom, and one in Palamow were working in the past year. As appears from statistics recently collected, the most important mines are found in the Hazareebaugh district. They are stated in the report to have employed 8,000 labourers during the year, the output being 331,178 tons, or 81,772 tons more than in 1877-78. Small quantities of coal were also extracted from the mines in Manbhoom and Palamow. The coal-fields of these tracts remain practically untouched, owing to the absence of easy means of communication with the rest of Bengal. Pergunnahs Jheria and Nowagurh in Manbhoom, comprise a vast coal-field, the area of which has been estimated by geologists at 200 square miles.

OUR COAL FIELDS.

A MAP of the coal districts of India will shew that the few coal deposits of India are confined to a belt, stretching from near the Assam frontier south-west to Bombay. This belt covers nearly five degrees of latitude, but becomes unpromising towards the Tenasserim Provinces, and altogether disappears in our presidency, south of the Kistnah. When Dr. Oldham, the Superintendent of the Geological Survey of India, wrote his report on the Coal Deposits of India, he came to very unfavourable conclusions both as to the quantity and quality of Indian coal, and laid it down authoritatively that a system of forest conservancy became, in consequence, a matter of serious importance. It is fortunate for railway purposes that the most workable coal is in close contiguity with the lines between Calcutta and Bombay, and that Central India coal will be opened up to a very promising extent. The Geological Survey did India vast good, but there was many fields that it did not care to investigate. As an instance of this neglect, we may mention the indifference to Captain Applegath's discovery of a very good description of coal in the Godavery district. His views were ridiculed as monomaniac, and the officer under whom he served in the Kistna division, and to whom his report was submitted, did not hesitate to say that Applegath was either the victim of a delusion or himself an unmitigated humbug of the first water. However poorly it treated Francis Applegath's schemes, the Geological Survey of India has done Indian coal deposits justice. There are many districts, however, which remain to be investigated, and of nearly all of them report speaks well. Nearly all the coal produced by the mines has come from surface-workings or open quarries. The deepest pits, Dr. Oldham said, were only seventy-five yards in depth; this is, certainly, an argument in favor of the mines; it speaks irresistibly to the credit of the economy of the day, but the fact must not be overlooked, at the same time, that, while such workings soon become exhausted, the exposure of the coal left in them must at the same time deteriorate in value. The East Indian Railway contractors used a good deal of this inferior coal, we are told, when constructing their line, but the want of roads prevented further attempts in this direction. The thickness of the seams was very encouraging, and striking off even half as not workable, a residue is still left very promising indeed. Dr. Oldham seemed to have been a very Nathaniel in this question of good coal. He did not anywhere deny that it was to be found in the districts named, but his reports of the material were so discouraging, that Government failed to take such action, as it might have done, under different conditions. His conclusion was that Indian coal gave only one-half the heat that English produce did; that it required more stowage and a greater number of firemen, and his handwriting on the wall was, unfortunately, accepted as final. Optimists though we may be set down to be, our canal navigation and demands for the article now point to a day, not very far distant, when coal shall be added to the other resources of India, and a long list added to them of resources which Nature, with no unmistakable hand, beckons us to come up and enjoy. The importance of Indian coal will continue to abide for many days. The railways alone, which have their *termini* at Calcutta, will consume more than half of this precious produce, and it is not unlikely that steamers will call for the rest. When this produce comes to be written off on the tables of our commercial resources, steamer freights and charges will come to be reduced, and prizes come to be won in our black diamond lotteries, which will create a plutocracy that India much needs. A discharge in full of all claims will be hers, and the profit gained by the coal will be nothing to the wider area over which her credit will be established.—*Madras Mail.*

THE INDIAN SALT RANGE.

THE *Pall Mall Gazette* to hand by the last mail, has a very interesting article on the Salt Range, in the Punjab, which has long been known as one of the most interesting and important regions of British India, chiefly on account of its highly fossiliferous rocks and enormous deposit of rock-salt, which, for extent and purity, are said to be unequalled in the whole world. Its mineral wealth doubtless early prompted the collection of information regarding it; and years before the conquest of the Punjab, British officers penetrated thither, often at great risk, and returned to report on its geology. Within the last ten years it has been carefully examined by Mr. Wynne, of the Indian Geological Survey, and his voluminous and interesting report thereon has just appeared. The Salt Range occupies historic ground—one extremity resting upon the Hydaspes, or Jhelum, and the other upon the Indus, or Abassin; while its eastern extension overlooks the battle-field of Chillianwallah, where that famous and desperate fight between the British, under Lord Gough, and the Sikh army

occurred in 1849. It is marked by a memorial obelisk, built of fine-grained sandstone taken from the range. The connection of the range with the outer Himalayan hills is broken through by the Jhelum valley, and its eastern portion is divided into three nearly parallel spurs. The Salt Range proper, lies entirely on the eastern side of the Indus, forming a somewhat elevated border to the Rawul Pindee plateau (lying to the north) and throughout its whole length of about 150 miles its steep declivities and lofty scarped cliffs, rising to an average height of 2,200 ft., abut on the vast semi-desert plain which spreads southward to the Arabian Sea. Mr. Wynne considers that it is a popular error to speak of the range as extending across the Indus and up to the Sufed Koh, in Afghanistan, as the salt there is believed to be of an entirely different age and position. In different parts of the range are to be found brine springs, hot spring (in the Bakh ravine)—the water of which is covered by a thin film of gypsum, and deposits a black tenacious mud used by the natives as dye for cotton cloth, and petroleum springs. Viewed from the north, the aspect of the range is that of a monotonously undulating and not very lofty ridge, with some conspicuous summits, covered with scrubby jungle or shrubs; while, from the south the scarcity of vegetation and the bright colouring of the red, purple, grey, orange, and whitish rocks of the cliffs and slopes present a strong contrast. The dry and sun-parched face of the range radiates so much absorbed heat, that an encampment at some distance in the plains though hot, is cooler than one at its foot.

Large deposits of salt are known to occur at Hormuz in the Persian Gulf, near the shores of the Caspian Sea, in Persia, in Algeria, Germany, and America; but those of the Indian Salt Range seem hardly inferior in extent and purity to any of these. It is by no means easy to attempt even a rough estimate of the enormous wealth of salt which is to be found here, but if an average thickness of only 135 feet and a width of three miles be assigned to the beds, then in the 130 miles along which these are seen, there may be a solid content of nearly 10 cubic miles. During the progress of Mr. Wynne's survey three mines were being worked on the eastern side of the Indus, and the open quarries of Kalabagh on the other side. The largest mines are the Mayo mines at Khewra. In these, vast but dangerous chambers had been opened up by the old Sikh workmen, who were so careless in their method of excavating that two heavy pillars supporting the roof of one chamber were left resting on a thick crust of salt spanning another large chamber below. This eventually gave way in 1870, and the ruins of the fallen mass were so great that quite a crater was formed on the hill in which the mines are situated. Ever since the advent of British rule, a better system of working has been introduced; and, instead of gaining entrance to the mines, by a slippery incline, one can now drive in upon a tramway through a spacious passage, in which due provision has been made for ventilation. The old chambers still remain to be contrasted with the new ones, and when illuminated with coloured or magnesium lights the effect of the brilliant crystal facets and stalactite masses in them is very picturesque. Not long ago gunpowder was never used in these mines for blasting purposes, but now its advantages are fully understood. From the Mayo mines Dr. Wurt estimates that 300 lakhs of maunds, or more than a million tons, have been removed, but notwithstanding the length of time during which these mines have been worked, and though each season adds a concentric belt to the excavated area, they show as yet no signs of becoming exhausted.

Passing by the Sardi and Varcha mines, which are of less importance, a few particulars may be given respecting the Kalabagh or trans-Indus quarries. These are all open workings in a thick group of salt beds, ranging from 4ft. to 20ft. in thickness. They run along the right side of the Lun or Gosai Nullah, the salt extending from the base of the hill as high up as 200ft. The outcrop runs for some two miles up the glen, and there are fourteen working places or quarries. A good idea of the quantity of salt produced by the Salt Range mines will be obtained from the value of the aggregate receipts from the four mines for the four years ending 1870-71. These receipts averaged £388,144 annually. Where the workings have been must carefully surveyed, the salt has been found in zones, consisting of several distinct beds within distances of about 600ft. 200ft. and less of the top of the marl and gypsum. There seems to be a larger development of so-called bad salt in the western than in the eastern part of the district, but it must be remembered that this bad salt would in other districts be extremely valuable. Although arrangements for the transport of the salt by wire tramway, and rail from Khewra are in progress, a very wasteful system of carriage still prevails. The salt is reduced to rough spherical lumps to prevent the corners from being rubbed off during its transport in open nettings or hair-cloth bags, and an enormous quantity of it is thus wasted.

Salt is not by any means the only mineral product of the Salt Range. Coal of a fair quality is found, chiefly at Bhaganwala and Kalabagh; petroleum in small quantity at Jaba; building-stones are obtained from the fine-grained sandstones of the purple standstone group, and ornamental stones from the variegated limestone. Besides these, gypsum exists in enormous quantities, and alum, gold, and other minerals are worked, but to no considerable extent.—*Indian Herald.*

It is estimated that the total product of the precious metals since the discovery of America has been £2,917,724,600, of which gold has constituted £1,322,440,000. The product in the sixteenth century is given at £296,125,680, of which gold constituted the larger proportion. In the next century the product reached £440,544,470, of which gold constituted a little more than one-third part. The eighteenth century yielded £741,635,550, of which gold gave £252,561,300, and in this unexpired century we have raised £1,449,469,010, of which gold has contributed £855,807,627. The estimates show a steady increase—from £1,174,330 in the quarter century preceding 1520 to £38,896,326 in the last seven years.

PETROLEUM AS FUEL.

A METHOD of using petroleum as fuel for steam boilers has been recently tried at Pittsburg (U.S.) with, it is said, complete success; and, as oil can be had anywhere in the region of the wells for about 70c. a barrel, the company who hold the patent believe that the invention will be readily taken up, especially by the owners of steamboats. It resembles, according to the Journal of the Franklin Institute, in its principal features, many of the forms previously described—air, steam, and oilspray being injected into a suitable fire-box. The spray is said to be immediately converted into inflammable gas, becoming a pure, bright, powerful flame, devoid of smoke and producing intense heat. To accomplish this result extremely simple machinery is used. A small hole is drilled into the iron front of the fire box, and into this passes a tube, which branches as it leaves this point into two pipes. One of these connects with the boiler itself, and the other with the receptacle containing crude oil. At the junction of these pipes there is an aperture for the admission of atmospheric air. Valves of peculiar construction regulate the quantity of steam or oil admitted into the furnace. This is all the machinery required, but its operation, according to the *Pittsburg Telegraph*, is wonderfully complete and remarkably successful. The little steamer *Billy Collins* was selected for the test, and was fired up at 9 A.M. A preliminary blaze of wood under the boiler raised the small quantity of steam necessary to start the burner into operation. The oil value was opened a trifle, the steam valve ditto. The petroleum trickled into the feed pipe, was caught up by the steam, and both plunged into the depth of the fire box, a mass of many-tongued, roaring, brilliant flames. As the pressure of steam increased, this flame grew in fury and intense heat roaring through the entire length of the boiler with a sound like the coming of a thunder-storm. The needle of the steam-gauge climbed rapidly up the dial, and in twenty minutes the safety-valve blew off at 120lb. pressure. Here was a boat puffing through the water with no sign of smoke from her chimney, no speck of soot in flue or fire-box, no fireman, no opening of furnace doors, no dirt, no coal going in, no clinkers or ashes to be seen anywhere. A turn of the hand regulated the terrible flame that seemed trying to overpower the limits of the furnace, and another turn of the hand brought the fire down to a quiet little flame a foot or two long. During the forenoon occupied by the test about 20 gallons of crude oil were consumed, and it was estimated that with oil at one dollar per barrel this fuel was equivalent to coal at six cents. (quantity not stated) in heat-producing value, other things being equal. But other things are not equal by any means, the journal referred to declares, and everything is in favour of oil as against coal. The labour and the expense of "firing up" are dispensed with, and the engineer can regulate the flame as he does the steam in his engines. The danger from sparks and flying cinders is entirely done away with. The space occupied by oil, as compared with an equal quantity of coal, is very much less, and this much is gained for cargo. Further the wear and tear upon boilers, grate, bars, &c., is infinitely less; and, it seems scarcely necessary to add, the comfort of passengers is greatly enhanced by the absolute freedom from dirt of all kinds. It is urged that to ocean going steamers this device must prove of great value. A tank of oil situated at a remote end of the ship would hold fuel sufficient for a double trip and supplant the great coalbunkers, with their attendant dirt. It is also maintained that the new furnace is full of promise for railway locomotives also.—*Society of Arts Journal.*

The Planters' Gazette.

TEA.

WE regret to learn that the tea industry in the Dehra Doon districts is meeting with but poor success; in fact, that for some time now tea planters there have had no return for capital laid out. We have positive proof of this in the "Report of the License-tax operations," which has just been published by the local Board of Revenue in which we read that Mr. Ross, the Superintendent of the Doon reports that the tax on "the tea industry did not bring in so much as Mr. Ross anticipated, *most of the tea companies proving by their books that they were working at a loss.*"

NEARLY all gardens this way have stopped picking leaf; sorting and packing is now the order of the day, competition is brisk to see who will despatch their tea first, pruning will soon commence. A number of the gardens below Kurseong, by way of Choonbutty, are very bad with musquito blight; for the last month they have been doing nothing. That valley seems to be visited yearly with some blight or other, now it is red-spider; then black blight, and lastly musquito, and every year a short muster; it is very strange.—*Darjeeling News.*

THE future of the Ceylon Tea enterprise may be most favorably affected by the news which has reached Colombo of negotiations between Ceylon proprietors of tea plantations and large tea dealers in leading provincial towns in the United Kingdom. It is said that in one case an agreement has been entered into by which all the tea produced and manufactured on a certain estate is to go to a Glasgow firm, on terms more favorable than at present rule in the retail market in Colombo, whereas, everyone knows, locally produced tea sells at a high figure—so far as the demand reaches. A local paper remarks that the example set will no doubt be followed in other cases, for there is plenty of scope outside of Mincing-lane, in London, Manchester, Birmingham, Bristol, Edinburgh, Glasgow, and Aberdeen, if only the large tea dealers can be got at, as well as in the capitals of the Australian Colonies; and in this way Ceylon tea, so highly esteemed wherever fairly tried, will get a reputation which "City" Brokers and experts may try in vain to shake.

A VISIT TO THE TEA DISTRICTS.

IT has often been asked of late—Why does tea not pay? and some very able letters have been written suggesting the reduction of some of the Brokers' and Agents' charges. Without stopping to discuss the merits of this proposal, I will proceed to give my experience of a short trip to one of the tea districts, and endeavour to bring to notice what appears to me to be *the* principal reason why the cost of production so often, in the present depressed state of the tea market, exceeds the return.

Early in the morning the Manager and myself went out to muster the coolies and set them to the work of the day; this done, we went round and saw that everything was going on satisfactorily. This took some time, and before we could get back to the bungalow the sun was uncomfortably hot. The morning soon slipped away, and 11-30 was on us in what appeared an incredibly short time. About this time I noticed men with their hoes shouldered making for the lines. Thinking these might be some of the lazy ones, I drew my host's attention to the fact, but was assured it was nothing unusual, as the men had finished their daily task. At 12 the gong was struck, the leaf-pluckers came in, and to the leaf-house we went to weigh the leaf. Here, too, I noticed that the people had mostly completed their task, and in many cases *exceeded* it. At 2 P.M., the gong was again struck, and the pluckers turned out, and also such of the men as had not finished their task. About 5 P.M., the people were called in, and we went to weigh more leaf; this time, however, I found an alteration in the arrangements. A table had been placed near the scene of operations, on which were counted out a lot of pice. As each woman's leaf was weighed, her total quantity for the day was called, and for all over and above the task she was paid. The sums varied from six pie to six annas. This was called "ticca" work. I have not much to record as to the progress of the work besides this: it was hoeing and plucking daily. Of course the manufacture was going on, and I was left to amuse myself as best I could for some hours daily, whilst my host was away looking after his tea. I shall not forget the expression of his face when he returned one day exceedingly "put out" about something. To every question I could think of, I could get replies in monosyllables only. But at last he gave vent to his feelings, and sought relief in confiding to me his troubles. The whole may be summed up by stating that the villagers had not been to work for two days, and he had just heard that this was due to his neighbour having raised the rates. A short interval of uneventful days, and the mohurir comes up to report that four coolies had absconded. Off go men in chase in every direction. Meantime information was sought from every conceivable source, but all that was obtained was as to the last time the coolies had been seen. On the fourth day the last pair of the men sent to search returned, stating that two boat loads of coolies had been taken down the river the night succeeding that on which the coolies absconded. There being no clue to their whereabouts, the presumption that they too were in the boats predominated, and further search was considered useless. I was destined yet to see one more annoyance in connection with coolies. This time three coolies came to the bungalow stating that their agreements had expired, and asking for their discharge. They were asked why they wanted to leave. "To go to our country." "But you have not money to take you there, how will you go?" A reply was given evading the question, and they were told to go to the lines and come again two days hence. Then ensued a series of inquiries as to why these people wanted to leave. No one knew; they were well treated, had easy work, facilities for living cheap, and what more did they want? But one wiseacre suggested they had been asked to go to——(——) in a small garden in a jungly place, being opened out by a manager on his own account, who was rather in want of labour it was said) This suggestion seeming not improbable, led to inquiry, and it ultimately proved true, for the three coolies confessed they were going there, as they had been promised Rs. 4 per head more than the usual present or bonus given on this garden.

As may be imagined, my host's troubles did not add to my pleasure, but it must not be supposed I did not enjoy myself. We went about to many gardens, and I took what notice my flying visit would admit, of the different modes of working; but as regard garden work I did not see much difference in any of them; the same five hours on and nineteen off for hoeing, and lots of pice for plucking leaf seemed the rule. But there was one matter which struck me very forcibly. I noticed some slight difference in detail of process of manufacture in nearly every tea-house I went to. It is not necessary, however, that I should here state exactly what I saw; suffice it to say that the above state of things does exist. And what struck me was the manner in which the conversation was changed by some of the planters when it got anywhere near "shop," as it was termed, meaning anything relating to the garden; and if I dropped any hint that I was a stranger and felt interested in seeing tea manufactured it was quite ignored. I have wondered since what the motive could have been. Had the man some secret in his tea-house, or was he ashamed of its arrangements? But I am pleased to say that such cases are very isolated, and it was a great relief to get away to the next garden, where the very reverse to the above treatment was met with. I was asked if I would like to take a walk through the tea-house, and when I got there every little detail was pointed out. I could feel that I was in the company of a man who takes a pride in his work, and, what is more, feels himself master of it. I cannot in this paper enter further into what I saw; I have already pointed out what I wanted, and at an early date will give a brief sketch of my "after-thoughts and suggestions."

F. E. D.

in Statesman and Friend of India.

Calcutta, October 28th, 1879.

TEA MARKET.

A LONDON correspondent writes:—Country buyers having abstained too long from the markets, and having allowed their stocks to run out, the strong spurt in tea has been maintained, and the market having been cleared of many unsound dealers, is able to take full advantage of the improvement. It is stated that a degree of firmness bordering upon excitement—such as has not prevailed since the season 1870-71, during the Franco-German war—has characterised the market. Buying has become general, speculators leading the way to the commoner sorts of tea, but is extended by the medium and finest kinds, and the tone of the market is still sanguine. One trade reporter remarks that "the total quantity likely to be exported from China is estimated at 155,000,000lb. and 38,000,000lb. are expected from India. A most important step in the direction of safer trading than has been carried on in recent years is the spreading of shipments over the season. Sailing ships are once more to secure a portion of the carrying trade." Messrs. J. D. Sillar & Co., in their circular, remark that the statistics for the last month are again strong, the bonded stock in the kingdom on the 30th ultimo being estimated at 90,000,000lb. against 112 000,000lb. last year. The imports for the nine months were 123,000,000lb against 145,750lb. during the first nine months of last year; while the deliveries were 151,000,000lb. against 149,000,000lb. last year. The quantity on the water is also considerably smaller than at the same time last year. "Accounts from China state that the stocks at all the ports have been cleared at an advance of about 20 per cent. upon prices ruling before the rise, and it is believed that fresh supplies will come forward from the country, although it is not expected that more than one-half the deficiency will be made up before the end of the season, the danger to the trade and to the public generally being that large quantities of re-dried, willow, and other leaves will be manufactured and shipped." The quantity of tea forwarded from Shanghai and Foochow to Tientsin and the north of China for transmission to Russia this year, according to latest written advices, amounted to 12,700,000lb. against 8,600,000lb. last year, and by late telegraphic accounts the Russian buyers had secured as much good and fine tea as they could. There is, therefore good basis for the opinion that we are likely to experience a scarcity of all good and fine teas before the next season's crop can be brought to market.—*Times of India.*

THE CULTIVATION OF TEA IN THE UNITED STATES.

THERE seems to be an impression in the United States that if the Americans choose they can grow anything. Some American gentlemen have demonstrated to their own satisfaction that tea can be grown, and they are making the most of the idea. A paper was recently read at the American Horticultural Society by Mr. William Saunders, of the Agricultural Department of Washington, upon the cultivation of the tea plant in the United States. Mr. Saunders said "The plant was growing in a nursery in Charlestown as early as 1812, but perhaps the first serious effort to introduce its culture was made about 1848. During 1858 the United States Government, through the Commissioner of Patents, introduced about ten thousand tea plants from China. These were placed under cultivation, and were soon increased to 30,000 plants,

which were distributed throughout the Southern States. Under the belief that the amount of manual labour required was so great, as to preclude the idea that America could compete with the cheap labour of Asiatics, no special efforts were made to increase or disseminate the plants. Since 1868, however, the department has annually distributed thousands of plants, and by this means it was hoped to popularise the culture of tea as a domestic product. Encouraged by reports of success, which were sometimes supplemented by samples of manufactured tea of good quality, more decided and energetic efforts have lately been made towards establishing this industry. The tea plant requires a rich soil. Even under the best conditions no leaves should be gathered until the fourth year from planting. A dry climate is altogether unfit for it, and a warm, damp climate is the best. The question of profit could be answered in a few years, if the Government were to secure a few acres of land in a proper locality and plant it with tea. Then when the plants become sufficiently matured, a series of experiments might be inaugurated in the preparation of the leaf. A total appropriation of 25,000 dols. would be amply sufficient for this service, if made available in such yearly sums as might be required for a period of not less than six years. It has been amply demonstrated that teas manufactured from plants grown in this country are of the best quality."—*Home and Colonial Mail.*

COFFEE.

MANURES FOR COFFEE.

OUR planter readers will peruse with interest the letter in which a gentleman largely interested in coffee culture in South India,* again gives Ceylon the benefit of his observation and experience According full weight to the fact that Mr. Tolputt agrees with Mr Crickitt in viewing the appearance of leaf disease as Nature's punishment for violation of her laws of nutrition and production, we can but ask our readers to apply to Mr. Tolputt's letter the remarks on this subject with which we accompanied Mr. Crickitt's. It seems important that we should know what that percentage of ash is which pure coffee should yield, for in the case of tea it is held as beyond doubt that the article is dirty or adulterated in the proportion in which the percentage of ash exceeds five. It is, we suppose, possible, that different modes and degrees of calcination might account for a difference of ash so great as that between Mr. Cochran's 4 per cent. and Mr. Tolputt's 2½. If the latter low proportion of ash is what pure coffee, properly treated ought to give, then the conclusion is inevitable, that the specimen which gave four per cent. was mixed with extraneous substances of some sort, perhaps had never been properly freed from the parchment skin? By coffee, we certainly understand the clean beans of commerce, and not coffee in parchment, far less coffee dried in the cherry. Professor Wrightson, of Cirencester, strongly recommended the use of kainat and its very richness in common salt, (which Ceylon produces abundantly, but the use of which in Ceylon agriculture the Government monopoly debars) seemed rather a recommendation, especially in the case of cocoanut palm culture where the use of salt is "indicated." as the doctors say. But we fear a large import would lead to Government interference, lest the muriate of soda should be separated from the muriate of potash. Where potash is needed,—and no doubt the circumstances of young estates, or those rich in decomposing felspar are very different to those of old properties,—then without question it is better to use the substance richest in the desiderated salt. Mr. Tolputt adheres to the views on the necessity of potash as an element in perfect coffee manures which he expressed in his original letters. Those views attracted the attention not only of Mr. Hughes but of Mr. Lawes, the greatest authority living on agricultural chemistry. Letters from both have reached us and until they are published, (in an early issue,) we defer any remarks we may have to offer on potash as an application to Ceylon coffee estates. As to lime, we have frequently suggested that the huge heaps of accumulated pearl "oyster" shells at Silavatorre ought to be utilized. They are of no use for European manufacturing purposes after lying for any time. Perhaps weathering may have lessened their value for our purpose too, or the questions of labour and freight may intervene. As regards the coral formations so common on our coasts and those of the portion of Southern India opposite Colombo, they have been, and are being largely utilised for lime, and we suspect the only limit to their larger use is cost of carriage. As road and railway communication is increased, this objection will be removed. As lime so greatly ameliorates—"improves the mechanical condition" of stiff clay soils,—it is scarcely matter of surprise that it should be regarded as a manure, instead of merely a digester and solvent. It is not only useful as an application directly to the soil, but for the "topical" treatment of trees affected by *hemileia vastatrix* and "black bug." In the latter case the benefit is great and speedy. Now that Ceylon planters have been fully awakened of the value of lime as an improver of soils and an enemy of insect and fungoid blights, there is no need to urge upon us its liberal but judicious use. Above and beyond all, most important seems the information which Mr. Tolputt affords regarding the Lacipede Island guano. The very absence of ammonia, which, no doubt accounts for the low price at which this substance sells in England, renders it valuable to us in Ceylon, for a culture which needs lime, in the shape of phosphate especially, more than nitrogenous matter. Could it not be managed that a vessel carrying to Australia a cargo of our coffee, tea, coir, &c., might bring back not merely Australian bones, but Lacipede Island guano? The question is one of cost, and if the substance can be sold in England for from £4 to £5 per ton, surely it could be carried direct to Ceylon and sold here for less? A substance which contains phosphoric acid equal to 62·87 per cent. tribasic phosphate of lime is worth looking after.—*Ceylon Observer.*

* This letter will be found in our Correspondence columns.—ED., *I. A.*

FROM the *Straits Times* we learn:—The coffee crop of the Government estates appears to have considerably exceeded the estimate in Mid Java. The crop in Kadu was estimated at 57,500 piculs, but 90,000 piculs have been received at the storehouses. The residency of Samarang was to produce by estimate 47,000 piculs, but the actual yield was between 60 and 65,000 piculs. Should this be the case everywhere in Java, the deficit in the Netherlands Indian estimates for 1880 will be easily remedied.

FROM the *Straits Times* we learn that "on the 24th September, 28,000 piculs first quality Government coffee, and 600 piculs second quality, were sold by auction at Padang at an average respectively of 59·69 and 13·15 guilders per picul. On the 29th September, 65,000 Liberia coffee berries were sold by auction at Buitenzorg at rates varying from 10 to 4 guilder cents each. Dr. Scheffer, the Director of the Botanical Gardens at Buitenzorg, in a letter to the Batvia *Dagblad* on Liberia coffee, states:—'The only thing which hitherto withheld me from recommending the planting of Liberia coffee otherwise than by way of experiment with a great chance of success, was my ignorance of the taste of the beans, and of the market value which depends thereon. I have however during the last few days tried coffee gathered at Chikeumeuh, and had it tried by others. Judgment was unanimous so far, that every one found that it was as good as Java coffee; some even, found it better. The published market value is in accordance with this. One great advantage of the Liberian coffee which I did not ascertain until lately is, that it again blossoms on old wood which common coffee very seldom or never does.

CACAO.

A CACAO estate in Trinidad of 830 acres, having 36,000 trees in full bearing, was recently put up to auction. The bids ran up to £7,600, but this sum was declared by the auctioneer to be below the reserve price, and no sale was effected. The property is about five miles from the port, up a good and easy road, and has in addition to the dwelling house, three cacao houses, two laborers' houses, and three laborers' barracks—all under galvanised roofing and floored. The reserve price was 40,000 dols., or rather over a dollar a tree, the buildings going with and forming part of that price. Taking the average value of cacao at 12 dols. per fanego (110lb. Eng.), and the annual average yield the usual one of 1½lb. per tree (the trees are planted at the usual short distance apart, which accounts for the small yield throughout the island). The ordinary crop would be 57,000lb. or 518 fanegas, worth 6,216 dols., and the cost of management, of stock, labor, bags, repairs to buildings, &c., being usually considered covered when so near town by 4 dols. per fanega; the net income would be 4,144 dols. or about 11½ per cent. on the capital embarked.

CACAO PLANTING.

As practised in the West Indies.

THE finest variety of cacao is that from Venezula generally known as *Larrccas cocoa.* The land in this country is generally well suited for the cultivation, but so low that it is exposed to inundations with any considerable rise of the rivers. The climate is at the same time very humid and warm; the thermometer occasionally marking 71° cent. The vegetation is so vigorous that the sugarcane, which, in the valley of Caraccas requires 18 months to ripen, is here cut after ten months, and attains occasionally the height of 27 feet. The system of irrigation is not practised, firstly because it is costly, and secondly, because the lands seem to retain their moisture in the height of the summer.

When commencing a cacao plantation, the first step is necessarily the clearing and preparation of the grounds. This is generally done in the summer, which is the months of January, February and March, so that all may be terminated before the first rains commence, in April and May.

Rows of plantations are then set to give shade to the young cacao trees until the "barcares" (species of Erythrina) are advanced enough to form shade trees.

The plantations are set at stated distances so as not to crowd the young trees, but a great deal in this depends on the nature of the soil and the species of cacao planted. In a virgin soil, where the tree is likely to attain a good size, the trees are placed 14 or 15 feet apart, so that in a space of 12½ feet square there would be one at each angle of the square. This distance is reduced where the soil is poorer. Some planters by a system of false economy plant their trees closer; but this is a bad system, for though there may be a greater number of trees to the acre, the production and vigour will be less from want of air, the trees will shoot up thin and weak and produce less fruit.

The species known as Trinidad Cacao, is rather larger and harder and requires more room, but it is usually planted in poor or impoverished soils. It has degenerated much, and is now chiefly distinguished from the Creole Cacao by its greater resistance to atmospheric changes, and by the character and treatment of its fruit.

If the ground is to be planted with bananas, as soon as it is possible trenches are made to draw off the water. Nature can best be followed in this by affording facilities for carrying off the excess of water arising from the heavy rains. In this consists the principal work of the planters of the

Rio Choco, and it entails the heaviest expense, because many insist that there should be a trench to each row of trees to ensure good crops and the healthy durability of the trees. The more it is intersected with channels for drainage, the more prosperous will a plantation be.

When the land has been planted with its rows of bananas, and furnished with its water channels, the next step is to plant young trees of *bucara Erythrina umbrosa, and E. Velutina.*

The cocoa tree requires the protective shade of another tree to thrive, and the younger it is, the more it requires shade, hence the banana or plantain suffices at first, but the bucare protects it during its after life. This shade tree is planted either by suckers or seeds in the interval between every three cocoa trees, or about 25 to 35 *feet* apart.

At the same time that the operation of preparing the plantation is going on, the nurseries of seed beds of young plants should be attended to, so that they may be ready for moving when about eight or ten months old. The work of transplanting requires great care, so as to have a ball of earth round it, and care must be taken not to injure the roots, for if these are damaged the plant dies off. The younger the plants are transfered, the better they succeed. It is better to form a plantation from seeds, if the necessary care can be given to the young growing trees without too much expense. In forming seed-beds the finest fruits are chosen fully ripe; they are opened with care, so as not to injure the seed, which are set a foot apart in furrows about two inches deep and slightly sprinkled over with earth, and then covered with plantain leaves. After fifteen days the leaves are removed, as the seeds will have sprouted. From this time to transplanting all the care necessary is to keep down weeds, which might choke the young plants. The tree requires to be kept free from weeds and ants, which are fond of its young leaves, and boring grubs, which attack the bark.

At three years the trees begin to flower, and a year after they produce some *fruit*, but it is not till seven or eight years that it gives any good *crop*. The age of fruiting varieties, in the interior of Central America, is about eight years, in the vale of Quapa seven, and about Equador and the banks of the Rio Negro five years.

When the trees begin to ripen their fruit, they are visited every fortnight, to gather the pods which are ripe, and to trim the tree a little. This is done by females and children. The women detach the fruit pods with a knife or chopper mounted on a long stick, and the children collect and carry them to the store, where the seeds some twenty-five to thirty-three in each fruit, are extracted. The fruit pods are of different forms and sizes, some nine inches or more in length are called "cous' tonques," others shorter and rounder, but on the whole larger, are called "anjolitas" these the most common, are a reddish colour, dark or light. The first kind are considered the best because the husk is thinner, and the fruit contains more seeds. It is generally a light red, but sometimes white at first, and turns a palish yellow when ripe.

When the seeds have been removed from the pod they are placed in a closed store house, in order that the viscous pulp may be separated. In dry weather a single night will suffice for this, out in wet weather they may be left for two or three days without inconvenience. They are then dried in the air, exposed to the sun in a courtyard or on drying frames, being turned about from time to time with a rake. Eight or ten hours of sun is generally sufficient; when this cannot be obtained, the operation is repeated on the following day, and they are housed at noon when the sun is at the hottest. They are left in the store to steam or ferment for a day or two. If the cocoa is the Trinidad variety, it requires four days or more to ferment, when it assumes the odour, colour, and taste of Creole cocoa, otherwise it becomes violet tinged and acquires a sharp and bitter flavour. Some growers expose the seeds on large sheets to dry, so that they can be quitely and readily housed in case of rain occurring. When properly treated and dried, the cocoa assumes in the interior a blackish tint or somewhat of a brick, its characteristic aroma is well developed, the taste is agreeable and unctuous, the interior of the seed assumes the colour of the Corinth raising and if it is opened with the nail, traces of the pod are seen.

This kind of cocoa was that formerly so much cultivated in these provinces, and considered the choicest, being especially demanded of the planters by the Guipuzcoanian Biscayan Company. It is not exactly the kind which is now sought after by shippers, who have a prejudice in favour of red cocoa for a natural or artificial colour. This is given either by red earth, brick dust, and occasionally by vermillion.

Between the appearance of the fruit and its ripening, there is an interval of nine months. The average yield of a tree may be taken to be one pound of cocoa, although some assume it to be one and a quarter pound. In a rich virgin and favourable soil the tree will last thirty-five or forty years, in poorer soil only twenty or twenty-five.—*Ceylon Times.*

CINCHONA.

A CORRESPONDENT to the *Ceylon Observer* writes :—" To show the value of cinchona officinalis, I may tell you that a proprietor in Rambodda has *refused* £500 per acre for his, aged from 3 to 4 years! He values it at £620 an acre, and has a considerable acreage planted." We can believe this, because we heard the offer was one of £40,000 for the property, which was refused!

PRODUCTION AND CONSUMPTION OF CINCHONA BARK.

WE have already given it as our opinion, that whatever may be the extension of cinchona cultivation in Ceylon, there need be no fear of finding a market for the bark that may be produced; for as its price declines it will increase in production, and so the fields for its consumption in the form of febrifuges will be larger. We have been assured, that at one shilling a pound, it will leave a good profit to the grower, and at that figure febrifuges should be produced so cheaply as to place them within reach of millions in India and China, who are now the victims of fever, but too poor to purchase quinine at its current price.

It was declared a few days since in the columns of a contemporary, that there are probably as many as seventeen millions of cinchona plants now growing in the interior of Ceylon. We stated some time previously that twenty millions would probably be about the number, but we are now assured on the best authority, that of one who has taken the trouble to institute and collect data, that by the end of the year, there will have been planted out thirty millions of seedlings during 1879, and that five years hence, there will be fifty millions of growing trees. From this number, however, we must make a liberal allowance for failures, which in some cases amount to fifty per cent. The present consumption of cinchona bark throughout the world is stated to be 10,000,000lb.; what it may become when the article has declined to one-third its present value, it is not easy to determine. But at the same time we must not forget that cinchona cultivation is making rapid strides in Java and various parts of India, and it is quite probable that in these two countries there may be a future production equal to that of Ceylon. Whether cultivation and artificial methods may enable the cinchona grower of the future to fix a large quantity of the alkaloids within the bark, is at present an open question, and it is no doubt that to obtain an enormously increased production will demand the most careful cultivation, and that the future ability of the market to absorb the entire yield of the world, will depend upon the cheapness at which febrifuges can be supplied to the million.

Fortunate, indeed, are these proprietors who embarked in this cultivation early in the day, and who now find themselves in possession of considerable tracts of the quinine yielding tree that can be turned to account, whilst the value of the article ranges at about its present rate, a certain fortune to the grower. Those who follow must be content, however, with a more moderate return.—*South of India Observer.*

SILK.

AILANTHUS SILK.

THE *Times* gives the following account of the acclimatisation of the Ailanthus silkworm :—

For a long time the mulberry silkworm has been the sole producer of silk known in Europe, and no other species has been able to rival it for the beauty of the silky staple of its cocoon. But now, after more than 30 years' persistent epidemics, it is really at a loss that European producers attempt to maintain here and there, without any certainty for the following year, a few silkworm nurseries. Commerce seeks in China and Japan, where labour is so cheap, the greater portion of the silks used for weaving. These silks, however, are of inferior quality, the peoples of the extreme East keeping with jealous care their finest products for home use. Thus our silk stuffs are no longer the magnificent tissues which were the glory of French manufactories, and we may see every day in the shop windows cheap stuffs that have far more "dressing" than silk. In these circumstances French manufacturers have been looking about to discover if no substitute exists for the time-honoured mulberry silkworm. For about a dozen years an imported moth has become a French insect, living in a free state and effecting its reproduction without any interference on the part of man. On the other hand, there is necessary for the rearing of ordinary silkworm, the purchase of healthy eggs, a nursery, and mulberry trees, implying expenses which lead to a great loss if the rearing is a failure. Many persons may have observed flying about in the evening in the month of June, in the squares, avenues, and in gardens, with ailanto plants in the neighbourhood of Paris, and even in Paris itself, a large month, with wings variegated by longitudinal bands. In winter, there may be seen hanging to the leafless branches long cocoons, of a pretty pearly gray. These are the work of the caterpillar of *Attacus cynthia*, or ailanto silkworm, introduced into France by the Acclimatisation Society, under the direction of M. Guérin-Méneville. The moth is now as much at home in France as in its native habitats, as robust, as large, and as well-coloured as in the north of India and China. No great welcome has hitherto been given to the new comer in France. The cocoon is not very rich in silk, it is strongly incrusted, and, on this account, presents difficulties in weaving, being regarded as good only for producing floss silk—a material of little value. Attempts have been made to wind it; but the winding yields only the single thread of the cocoon—too fine to be used, and requiring special and expensive machinery. This question has now, however, been taken up and solved by M. le Doux. He has succeeded to some extent in separating the gum from the silk, permitting the threads to be

drawn with great ease, and preserving to them, at the same time, sufficient natural glue to admit of the threads of several cocoons wound at the same time being, by the operation of twilling, twisted together and giving strands of raw silk, the only kind that can be utilised in weaving. Another chief point in the discovery of M. le Doux is that this production of raw silk is obtained with the same pains and the same hand processes as ordinary raw silk, so that no objection can now be raised on the score of expense. The specimens of silk produced are of a pretty blonde colour, and make charming stuffs of *écru* colour. Moreover both French and English dyers will know how to give the silk a variety of colours. The rearing of this new silkworm requires neither care nor expense. The wild moths look after themselves, and it only remains to collect the cocoons attached to the leaves of small branches. The ailanto tree of Japan, on which the worm feeds, is of rapid growth, and admirably adapted for covering waste spaces.

SILK FROM THE SEA.

THE sea yields many precious things—coral, amber, and pearls —but it is not generally known that in certain parts of the Mediterranean a species of mussel is found, of which the shells contain one of the most beautiful textile materials known. These shells are about 7 inches long and 3 inches broad, and each of them contains a hank or byssus of the fibre, weighing half a drachm, and at first it presents nothing particular to the eye, being soiled with mud and the remains of marine plants. But when washed and combed the fibres are seen to be extremely lustrous, glistening in the sunshine in shades varying from a golden yellow to olive brown. Spun and woven in the ordinary manner, stockings, gloves, neckties, and similar articles can be manufactured from them, and they are likewise specially suited for making the finest lace. At present the production of these fibres hardly exceeds 200 killogrammes (3 cwt., 3 qrs.) a year. Specimens of these curious mussels and their finished products were exhibited at the recent Paris Exhibition, but they appear to have been overlooked.—*Cassell's Magazine.*

TOBACCO.

FOLLOWING the example of Jamaica, Cape Colony is taking steps to bring into the markets of the world, in a manufactured state, the supplies of tobacco, of which it is capable of producing such large quantities and so good a quality. The tobacco plant flourishes in South Africa, and considerable crops are reared annually, the produce of which is employed for manufacturing and fumigating purposes. As yet, however, the careless and primitive methods of preparation have prevented the colonists from smoking their home-grown tobacco or home-made cigars, and large quantities are annually imported from abroad. Jamaica cigars are now, thanks to greater care in their manufacture, making quite a name for themselves in the English markets ; and there is no reason why the Cape colonists should not, by showing similar enterprise, grow enough tobacco and make sufficiently good cigars to supply at least their own wants, without importing, if not to export a considerable quantity to other countries. An effort is being made to establish a tobacco factory in King William's Town, when every care will be taken to ensure the proper manipulation of the fragrant weed, and to place home grown produce on an equality with foreign tobacco and cigars.—*Colonies and India.*

THE POSITION OF TOBACCO CULTURE IN INDIA.

THE following paper by K. Schiffmayer, Assistant Superintendent, Government Farms, will be of interest to our readers :—A proper rotation of crops being advantageous generally, must be particularly so for the cultivator of tobacco, since tobacco requires a great amount of readily accessible inorganic matter in the soil, especially potash and lime. Although the importance of cultivating tobacco in rota tion is admitted, there may be circumstances that justify the growth of this crop successively for several years in the same field. In America, tobacco is grown successively for several years on new land, that is, virgin soil, where the elements of plant-food exist in such abundance, that the tobacco c rop may be thus cultivated without for a time showing any notable decrease in yield ; it is even said that the outturn of the second year is heavier than that of the first. In Hungary and Holland, the best tobacco is grown for many years in succession of the same land. There the plan is adopted partly out of necessity and partly for convenience. The small landowner is often obliged to grow tobacco on the same field, because he has only one piece of land properly fitted for tobacco cultivation ; for the sake of convenience he grows his tobacco every year on the same place near his ho mestead, to allow him to pay the closest attention to his crop ; he will, however, manure heavily. Nessler, in Carlsruhe, cultivated tobacco during six consecutive years in the same field without noticing any perceptible decrease in yield or quality. To admit of such a system, the soil must either be very rich in the elements essential for the successful growth of tobacco, or heavily manured, as is the practice in Holland. It is generally assumed that ; when tobacco is grown on the same field in succession, the leaves do not become so large after the first year, but grow thicker and more gummy and contain less water.

From the foregoing it would appear, that although tobacco may be grown successfully on the same land in succession under special circumstances, the cultivator will find it advantageous to adopt some plan of rotation. Cereals and pulses are very well adapted for cultivation in the course of rotation. The reasons for this is that as tobacco removes but little phosphoric acid from the soil, the sa me must be enriched in the element most necessary for the growth of cereals. It has also been fo und that hemp thr ives particularly well after tobacco.

Selection of Species.—Amongst the many requirements that must be fulfilled to ensure success in the cultivation of tobacco, not the least is the proper selection of species and variety. The cult ivator must carefully compare the demands that the different varieties make, and the means at his disposal to satisfy them before he makes his selection. Although tobacco is a hardy plant and grows under varied conditions, yet to become a remunerative crop, the plant should not be placed under circumstances much dissimilar to those to which it is accustomed. By the agency of these circumstances, the characteristics of the different species and varieties have been chiefly developed ; the absence of the agents must necessarily involve an alteration in the product. Thus it is evident, that by importing seed of a fine species directly from its native land, the plants will not retain in the new habitat all their special qualities, unless climate, soil, and treatment are nearly the same. It is true that some fine species of tobacco, which have been introduced in Germany, Hungary, Holland, etc., are successfully cultivated there, and are highly value d ; but the high price this tobacco commands there in some places, is not so much due to those qualities for the sake of which they are so highly esteemed in their native land—the aroma—but to qualities resulting chiefly from the mode of cultivation, and the treatment of the produce. By digging over his rich alluvial soil two feet deep, and manuring at the rate of 25 tons per acre, and paying the utmost attention to his tobacco, the Dutchman is able to compete successfully with France and Hungary, and receives as much as Rs. 44 per 10 lb., and a gross income of Rs. 700 per acre planted with tobacco. Although this shows how far climatic deficiencies may, with regard to profitable cultivation, be supplanted by intelligence, yet it must be admit ted that this can be done only under peculiar circumstances, and applies especially to the small landholder. In selecting a species of tobacco, the climate must first be considered. As shown above, fine and valuable tobacco is a product of tropical countries. In a warm climate, possessing a certain amount of humidity, by employing common means, a tobacco may be raised that yields a profit not attainable in less favoured regions. A warm moist climate admits the selection of those species of tobacco, that command the highest prices ; if to this be added a suitable soil and proper treatment of the t obacco, the cultivation of this plant yields a profit not easily obtainable by the production of any other crop.

The following table shows the price that the Austrian Government paid per 100lb. of imported tobacco in 1868 :—

For Manila	tobacco	...	...	89	florins.*
„ Havana	„	...	...	78	„
„ European Turkish	„	...	...	72	„
„ Cuba	„	...	...	84	„
„ Asiatic Turkish	„	...	...	26	„
„ Varinas (Kanaster)	„	...	...	48	„
„ Syrian	„	...	...	55	„
„ Virginian	„	...	...	35	„
„ Brasilian	„	...	...	23	„
„ Kentucky	„	...	...	35	„
„ Java	„	...	...	66	„
„ Maryland	„	...	...	29	„
„ Holland	„	...	...	26	„

The highest price paid for Hungarian tobacco was only 22 florins per 100lb. It will be noticed from this table that there is a great difference in the price. The Manilla and Havana varieties commanded the highest prices, but it must be remembered, that some Havana tobaccos command a much higher price than these figures show. The highest price is commanded by the tobacco raised in Vuelta, Abajo, on the west coast of the island of Cuba, for which sometimes as much as Rs. 750 is paid for 100lb., and as much as a rupee is paid for a cigar. For tobacco raised in the interior Rs. 5 per lb. is frequently paid in Bremen.

The French Government sold nearly 200,000 kilogrammes of imported genuine Havana cigars in the year 1867, at an average price of 59 francs per kilogramme. It is calculated that 250 cigars weigh one kilogramme (about 2·½lb.). Manilas were sold at the rate of 20 and 15 centimes per cigar. As of all tobaccos, the Havana varieties command the highest prices, the cultivator nearly everywhere attempts to introduce and to cultivate these varieties ; the tobacco, however, sp eedily degenerates and forms new varieties if the climatic conditions, &c., are not favourable. It would appear that Havana tobaccos are not properly classified as yet—they apparently belong to several species.

The Virginia tobacco (*Nicotiana angustifolia*) was previously extensively cultivated, but has of late been frequently displaced by the Maryland species. It is, however, still much fa voured by cultivators in temperate climates, as it does not require a high temperature. Virginian tobacco is, on account of its botanical characteristics, usually not much liked by the manufacturers of cigars. As the price of this tobacco is rather low, it is not so well suited for export as the *macrophylla* species. Hungarian tobacco (*Nicotiana rustica*) is considered to be a very hardy, but a less valuable species than

* 1 florin is worth about 2s.

the foregoing. The leaves are generally small and possess a particular aroma.

A high price is generally commanded irrespective of the species, by those tobaccos that possess a large smooth thin leaf, which is elastic and has a fine golden colour and a good aroma; the ribs and veins should be thin and the former branch off from the mid-rib at nearly right angles, and should be far apart from each other. The lower the percentage of the weight in ribs, the thinner and broader the leaf, the fewer of the same that are torn, the more wrappers can be cut out of 1lb. of tobacco, other conditions being equal, and consequently the higher is the price of the article. The manufacturer of cigars often does not appreciate the aroma so much as the other qualities. He can do nothing to improve the botanical characters; the finest aromatic leaf would be of but little value to him, if it were torn; but he is able to improve by artificial means to a certain extent defects in flavour. Of all species *Nicotiana macrophylla* is considered to possess the qualities that distinguish a good tobacco in the highest degree. Some of the Havana tobaccos belong to this species, as also the Ohio, the Ammersfort, Turkish, and the Dutten tobaccos. The cultivation of this species assumes larger proportions every year, and the number of varieties and sub-varieties increases accordingly.

Raising Plants.—A light friable soil being the best adapted for tobacco cultivation generally, is particularly well fitted for raising plants in the nursery. To obtain this, the soil intended for a nursery should be broken up to the depth of 1½ feet some months before the sowing season. A drain should be dug round the nursery, and the soil obtained, utilized in raising the surface. The best time for transplanting tobacco in the field in this neighbourhood would be immediately after the north-east rains; the plants would then most probably reach maturity without the aid of irrigation, the moisture in the soil and the heavy dews at that time being sufficient; and, as for the production of a fine leaf, a moist climate is considered necessary, the value of the outturn would be much enhanced. If, however, the seed had to be sown before the monsoon, the young tender plants, unless carefully sheltered from the wind and heavy rains, would most probably succumb to the inclemency of the weather. It may therefore be assumed that where the rains are very heavy, the time for sowing in India is immediately after the heavy rain of the monsoon is over. The soil should therefore, in places enjoying the the north-east monsoon like Madras, be broken up not later than the end of August. Unless the soil be very rich in humus, it should be heavily manured with well preserved farm-yard manure soon afterwards. The soil of a tobacco nursery cannot contain too much organic matter; it is said that one containing as much as 20 per cent. of this substance produced the most vigorous plants which developed a great number of fibrous roots. A soil containing much humus will prevent to a great extent the formation of a surface crust which is so detrimental to the development of the plants during their early growth, and will also facilitate the extraction of the plants when transplanting takes place. After a few weeks have elapsed the soil should be dug over a second time, and the whole reduced to a fine tilth. The land may now remain untouched until the sowing time, unless weeds should spring up; these must be eradicated.

The area required for a nursery depends on the area of ground to be planted, and on the distance the plants require to be planted in the field. To plant an acre with tobacco plants two feet apart in each direction, 10,890; three feet in one and two in the other direction, 7,260, and to plants three feet apart in each direction, 4,840 plants are required. To ensure a healthy growth of the young plants, about a square inch space should be allotted to each in the nursery. Taking the number of 7,260 plants as that required for an acre, and giving each plant one square inch room, an area of 7,000 square inches or 50 square feet, would be required to raise plants sufficient for an acre. As, however, the plants are apt to be injured during their first growth, and many are rendered useless in lifting them for transplanting, as also a number of plants must be kept as reserve to replace those that die after transplanting, the provident cultivator will do well to raise double the number of plants actually needed. It may, therefore, be laid down that 100 square feet of nursery bed is required to raise plants sufficient for an acre.

The amount of seed required to raise plants for an acre depends chiefly on the vitality of the seed. An ounce of tobacco seed contains about 100,000 grains, so that, on the supposition that a plant can be raised from each grain, nearly seven acres could be planted with the seedlings raised from one ounce of seed, according to the foregoing calculation. As, however, even the best tobacco seed has not a very high percentage of vitality, between half an ounce and one ounce of seed is generally sown to produce the plants required for an acre.

The time of sowing having arrived, the nursery should be divided in beds. The most convenient arrangement would be, for the sake of weeding, watering, &c., to divide the whole into beds 10 feet long and 5 feet wide, making 50 square feet each, on which, as seen above, plants for half an acre can easily be raised. As even with a small tobacco plantation, several days are required for transplanting, all the beds should not be sown at one time, but various plots should be sown at intervals of a few days. This will also lessen the risk of the young plants being all destroyed by a storm, insects, &c. Before sowing the seed, the soil should be dug over to the depth of six inches and levelled with a rake. The seed must then be sown evenly on the surface and beaten down slightly with the hand or otherwise. The seed being very small, many cultivators mix it with ashes in order to be able to distribute it regularly over the bed. The seed must be covered only slightly; the best way to do this is to strew some fine compost manure over it. Ants, which often destroy the seeds, may be kept off by sprinkling some ashes over the bed. Finally, some cut straw may be spread on the surface. To protect the nursery from the sun and rain, the whole should be covered with a roof made of straw leaves, or cloth supported by poles. This roof should be only a few feet from the ground. The soil of the nursery must be kept constantly moist but not wet. Watering with a fine-rosed watering-pot will be required once or twice a day, according to weather and the amount of humus in the soil.

The plants, which will appear about a week after sowing, are very tender during the first stage of their growth, and require frequent watering; a little water only should be applied at one time with a watering-pot provided with a fine rose. The use of the straw will be apparent as it will prevent the water falling with any force immediately on the plants and prevent the wash of the soil from the fine rootlets. If the plants spring up very thickly, they should be thinned out, when about a week or two old, leaving say one square inch space for each plant. The plants taken out may be used to fill blanks in the nursery bed, or, if there are more plants to be taken out than required for this purpose, they should be planted in a separate bed. It is universally acknowledged that plants transplanted when very young develop more roots, grow more vigorously, and become more hardy afterwards than when not transplanted at this stage of growth. When the plants are about two weeks old they require less attention, and should be watered less frequently to harden them before transplanting. Any weeds appearing must be removed, and insects injurious to the plants must be killed. In about seven or eight weeks after sowing, the plants will be fit for transplanting.—*Planters' Gazette.*

Registered No. [illegible]

INDIAN AGRICULTURIST.

A MONTHLY

JOURNAL OF INDIAN AGRICULTURE, MINERALOGY, AND STATISTICS.

VOL. IV.] CALCUTTA : MONDAY, 1st DECEMBER 1879. [No. 12.

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Sold in Bottles 2*s.* 6*d.* each, and in cases, containing six times the quantity, 11*s.* each—sufficient to effect a permanent cure in the great majority of long-standing cases, BY ALL CHEMISTS and PATENT MEDICINE VENDORS throughout the world.

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Castle	E	Pale Cognac BRANDY, 17 under proof	..	„ 27 0
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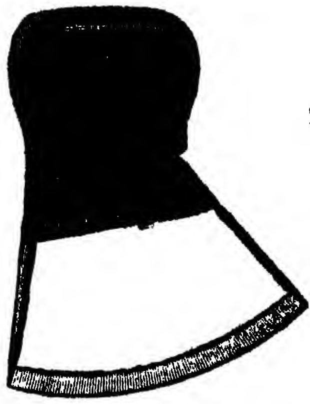

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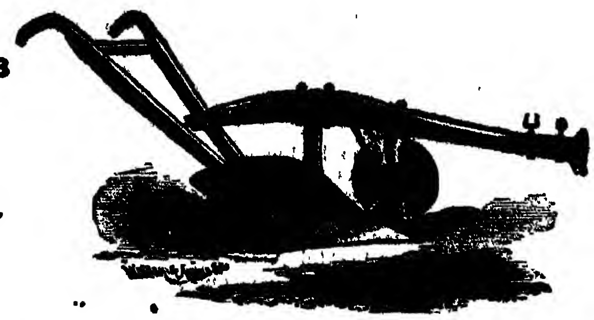

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Will stretch less than those made of ordinary leather, thus saving both the time and trouble so frequently expended in taking up belting; while for agricultural purposes, where the Bands have to remain in the open, this Leather will be found invaluable.

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